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LIFE OF
GEORGE STEPHENSON



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FRONTISPIECE.

GEORGE STEPHENSON.

GEORGE STEPHENSON:

His Life and Career.

BY

F. L. CLARKE,

Author of "The Life of Raleigh," "The Life of Tynedale," etc., etc.



LONDON:

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PREFACE.

THE name of GEORGE STEPHENSON is so well known in connection with railways and locomotives, that but very few words are needed to explain the scope of this little book, which aims at giving, in a smaller compass, that which Mr. Smiles has so admirably given in his interesting and exhaustive "Life of George Stephenson." Technicalities have been avoided as far as possible, or explained, so that younger readers may read and enjoy the details of the life-struggles and the success of this noble advocate and example of the virtues of perseverance.

One of the many advantages that biography possesses over narrative-fiction, lies in its *reality*. The men and the women whose careers are so constantly brought before us were really flesh and blood like ourselves—they played their part in the world's drama, they had their faults, their enemies, their friends, their successes just as we have, or may have, and we can

feel that what man has done, man may do again. When the boy or girl reads an interesting book, one of the first questions is, "Is it *true*? Did it really all *happen*?" and their enthusiasm is much damped when informed that such and such a hero—the very good boy, and the exceedingly amiable girl—had no real existence: their virtues and their faults, their trials and sorrows, through which they pass so triumphantly, were all imaginary, though they *might possibly* be true. "Oh," is the comment, "they are only people in books. We can't be like people in books, you know;" and so the wise lesson often passes unheeded.

Not such can be said of George Stephenson. The trials and difficulties of his early life can hardly happen in these more favoured days of general education, but the example of his watchful patience, his unvarying industry, and the thorough kindness of his whole nature can hardly be thrown away upon any reader. He is not a "character in a book;" he is a real living person—the results of his thoughtful youth and manhood have greatly tended to England's prosperity. The energy which he threw into whatever he undertook has roused and ani-

mated the energies of thousands of others to whom the perfection of the locomotive has been the very means of their existence.

Wherever we see him, whether taking care of little children, scaring birds, or by the pit-engine fire studying his scanty lessons, we see the same thoroughness, the unflagging industry—sometimes called genius—which characterized him in his manhood's prime, when before the eyes of a critical public he produced the complete locomotive engine, which had been the object of desire of so many before him. To him it was given to perfect this wondrous piece of mechanism, and he knew and acknowledged with all humility that he was not the originator—he but ended the long line of men whose "heroic industry" led up to one of the greatest triumphs of mechanical science. "It is due," said his son at a meeting of engineers at Newcastle, "not to one man, but to the efforts of a nation of mechanical engineers."

F. L. C.

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GEORGE STEPHENSON.

CHAPTER I.

NORTHUMBRIA AND HER PEOPLE.

BEFORE entering upon the life of George Stephenson, we will take a short survey of the times in which he flourished, and of the characteristics of the county in which he lived.

“Until the middle of the last century,” says Smiles, in his “Lives of the Engineers,” “the roads across Northumberland were little better than horse-tracks, and not many years since, the primitive agricultural cart with solid wooden wheels was almost as common in the western part of the county as it is in Spain now.”

Since that time great changes have taken place on the Tyne. When wood for firing

became scarce and dear, attention was turned to the rich stores of coal lying underground in the neighbourhood of Newcastle and Durham. It then became an article of increasing export and "sea-coal" fires gradually supplemented those of wood. Hence an old writer described Newcastle as the "Eye of the North, and the Hearth that warmeth the South part of the kingdom with Fire." Coal wagons were made, then rough wooden rails were laid down to convey the coals to the river; these wagons were drawn by horses, and many thousands of people were employed both in digging and conveying the coal. Similar wagon-roads were afterwards laid down in Wales, Cumberland, and Scotland.

In the rude wooden tracks just mentioned lay the germ of the modern railroad. These tracks were gradually improved. Thin iron plates were nailed on them, and then eventually they were made entirely of cast iron. The first rails of this kind are believed to have been constructed at Whitehaven, as early as 1738, and were called a "plate-way," from the plate-like form in which they were cast. In 1800, Benjamin Outram, father of the distinguished

soldier, General Outram, employed stone props (instead of those of timber, which had hitherto been used) for supporting the ends or joinings of the rails, and the roads so constructed were called "'tram" roads. We use the same term still, but our modern "tram roads" are made for very different conveyances than the rough coal wagon, the desire for the better propelling of which has resulted in such great and unthought of improvements. We must not forget that all ordinary traffic was carried on by horses, mules, ponies, and asses, over whose backs the burdens were slung, pannier-wise, or packed up in great heaps in the tram-road wagons.

At the time when George Stephenson was born, stationary engines were used to raise or lower the corves, into which the coal from the pits was placed. The men frequently used these corves, either going to or returning from their "shift."

Previous to the invention of these engines, the corves were raised or lowered by a machine called a "gin." This consists of a large drum standing upright, round which strong ropes, attached to buckets and corves, are wound.

The ropes were wound and unwound by a horse, which moved in a circular track called (ironically one would think) a "gin race." We have seen horses still used for this purpose at the mouth of small pits.

Among the workmen of a mine, beside the miners themselves, are the firemen, enginemen, and brakemen, who work the engines and superintend the machinery by which the collieries are worked. The Stephensons were familiar with mining operations, and it was chiefly from observing the action of the stationary engine that George Stephenson conceived the idea of a locomotive. This invention, like most others, was made by successive steps. It was not the invention of one man, but of a number,—one inventor succeeding another, and further solving the problem, until the time came for Stephenson to give the final solution. "The locomotive is not the invention of one man," said Robert Stephenson at Newcastle, "but of a nation of mechanical engineers."

Newcastle, of which we shall hear so much, is a singular town of great interest, "especially in its older parts, which are full of crooked lanes and narrow streets, wynds and chares,

formed by tall antique houses rising tier above tier, along the steep northern bank of the Tyne, as the similarly precipitous streets of Gateshead crowd the opposite shore."

A *chare* in Newcastle dialect is a narrow street or lane. A story is told that at a local assize one of the witnesses swore that "*he saw three men come out of the foot of a chare.*" The astonished judge cautioned the jury not to pay any regard to the statements of a man who was evidently insane! A short explanation from the foreman, however, satisfied his lordship as to the truth of the statement.

The character of the pitmen or "lads below" is almost unique. They have peculiar habits, manners, and customs, and are quite distinct from those who work above ground. They were, in Stephenson's time, a rough, badly educated class, much given to "steeks" or strikes, and extremely fond of cock-fighting, dog-fighting, hard drinking, and donkey races. They were paid fortnightly, and on pay-day a regular saturnalia commenced, for their pay was very good. The last thirty years has seen a marked change for the better in the moral condition of the miners of Northumbria; the

influence of day and Sunday-schools, with the important changes wrought by railways, have raised them to an equality with other labouring classes.

Before bringing this preliminary chapter to a close, we will explain a few terms used in coal districts. "Arrived at the staiths," says Smiles, "the wagons are emptied at once into the ships waiting alongside for cargo. Any one who has sailed down the Tyne from Newcastle Bridge cannot but have been struck with the appearance of the immense staiths built of timber which are erected at short intervals on each side of the river." A staith is a sort of high deck, from whence the coal is shot down into the vessel. A great deal of the coal that is shipped from the Tyne comes from above bridge, where sea-going craft cannot reach ; this is put on "keels," of a very ancient description ; modelled, some people say, from those used by the Norsemen who navigated the Tyne many centuries ago. The keel is a tubby, grimy-looking craft, rounded fore and aft, with a single large square sail, which the keel-bullies, as the Tyne watermen are called, manage with great skill and dexterity ; the vessel being guided by

the aid of the "swape," or great oar, used as a sort of rudder at the stern.

These keelmen are an extremely hardy class of workmen, not by any means as quarrelsome as their name "bully" implies, the word being a corruption of "boolie," or beloved, a name still in use among the workers of the coal districts. One of the curious sights of the Tyne is to see hundreds of these black-sailed, black-hulled keels come floating down at every tide, bringing their black cargoes to the ships at anchor at Shields and other parts of the river below Newcastle.





CHAPTER II.

GEORGE STEPHENSON'S BIRTHPLACE AND EARLY DAYS.

GEORGE STEPHENSON was born on the 9th of June, 1781, in the little village of Wylam, distant about eight miles from Newcastle. He was brought up amidst the associations of cinder banks, coal heaps and blast furnaces.

His grandparents hailed from beyond the Tweed, and from them George may have inherited his plodding industry and earnestness in whatever he undertook, which gave such a definite individuality to his character. His father—"old Bob," as he was usually styled by his friends—and his wife Mabels, were a respectable, hard-working couple; from the latter, George inherited the considerable amount of energy and will power which she displayed in

spite of a nervous temperament and a weak constitution.

An old Wylam collier, who remembered George Stephenson's father, thus describes him: "Geordie's fayther war like a peer o' deals nailed thegither, an' a bit o' flesh i' th' inside; he war as queer as Dick's hatband—went thrice about, an' wudn't tie. His wife Mabel war a delicat' boddie, an' varry flighty. Thay war an honest family, but sair hadden doon i' th' world." The earnings of old Robert did not amount to more than twelve shillings a week, which, with six children to keep, left them with nothing to spare for education; so George was more ignorant than any street Arab of our times, who may elude the vigilance of the school board, perhaps, but still somehow learns to read. George's father (whom we must call "old" Robert, to distinguish him from his famous grandson, of whom we shall speak hereafter) was a great favourite in the village among his mates, and especially among children, who were accustomed to gather round him while he was tending his engine—for he was fireman to a colliery pumping engine—and listen to his stories. When his memory gave

out, he would draw largely on his imagination, so that "Bob's engine-fire" came to be a favourite resort in the village. We may be sure George was not the least eager of his listeners.

Besides the children, he often had a flock of almost tame birds, principally robins, who would hover about him to pick up the crumbs saved from his scanty dinner. George was happy in having such a father, who, if he could give his children little of this world's goods, could bestow upon them a wealth of affection well calculated to bring out their deepest love and to strengthen their home ties in a manner supposed to be rare among the poorer working classes, and which many a more prosperous family might do well to emulate. In summer time he would go bird-nesting with his little ones; and on one memorable day that the boy never forgot, his father took George a walk and showed him a blackbird's nest for the first time! Holding him up in his arms, he let the wondering child, to his intense delight, peep into the birdie's treasures. Even when an old man, George used to speak of this to his intimate friends, and always with pleasure. Both George and

his father acted up to the lines of Coleridge, when he says, —

“He prayeth best who loveth best
All things both great and small,
For the dear Lord who loveth us,
He made and loveth all.”

George led the ordinary life of a working-man's child. He went on errands, played with other children, and went bird-nesting when he could. He, like the others, was fond of listening to his father's tales, and he early learnt from him that affection for birds that lasted throughout his life. As he grew older he was promoted to carrying his father's dinner, and it was his delight to see the robins fed. At home he was caretaker of the younger children, and kept them out of the way of the big chaldron wagons, which were then dragged by horses along the wooden tramroad which ran in front of their cottage. This cottage, only a part of which was occupied by the Stephensons, is now shown with great pride by the people of Wylam, as being the scene of the early days of their “great man.”

Eight years passed thus, and then, the coal having been worked out of the pit at Wylam,

the family removed to Dewley Burn Colliery. Young as George was, he now began to add to the family earnings; in a very humble way, however. A widow named Grace Ainslie then occupied the neighbouring farmhouse of Dewley. George's duty was to keep her cows from straying off the grazing track into the way of the wagons, or from trespassing on the neighbours' "liberties;" he also had to bar the gates at night after all the wagons had passed. For all this George earned the magnificent sum of twopence per day! He was possessed of shrewd mother-wit and ready resource, as the following tale will show:—

One day his sister Nell went into Newcastle to buy a bonnet, and Geordie went with her to witness the interesting purchase at a draper's shop in the Bigg Market. Nell found a "chip" that she liked; but alas! the price was too high by fifteenpence, so she had to leave it, very much disappointed. But Geordie said, "Never heed, Nell; see if I cannot win siller enough to buy the bonnet; stand ye there till I come back." Away ran the active little fellow and disappeared in the throng of the market, leaving the girl waiting for his return. Long she stood

there, growing very frightened in case harm had happened to the child, when at last he came running, breathless and panting out, "I've gotten the siller for the bonnet, Nell!" "Eh, Geordie!" she cried; "but hoo hae ye gotten it?" "By haudin' the gentlemen's horses," was his triumphant reply. The much-desired bonnet was immediately bought, and the two returned to Dewley quite happy.

George transformed his work into pleasure by making lilliputian mills in the water streams, whistles out of reeds and "scrannel straws," keeping as good a look-out on his fourfooted charges as he had on his baby brothers and sisters. His favourite amusement was erecting clay engines, in which he was joined by his chosen playfellow, Bill Thirlwall. The spot is still pointed out where these two future engineers made their first attempts in modelling. Clay they found in an adjoining bog, and the hemlocks which grew near supplied the imaginary steam-pipes. They even made a miniature winding-machine, and joined it to their engine, and fixed their mimic machinery upon a bench in front of the Thirlwalls' cottage. The corves were made of hollowed corks; the

ropes were represented by twine, and a few bits of wood supplied the rest of their materials. The boys made a show of sending their corves into the pit and drawing them up again, much to their parents' delight, and to the wonderment of the pitmen. Some mischief-loving or perhaps jealous person one night smashed this frail engineering effort, much to the grief of its owners.

George never allowed recreation to stand in the way of wage-earning; so we next find him, at fourpence a day, hoeing turnips and leading plough horses when he could scarcely stride the furrows. He used afterwards to say that he rode to his work in the mornings when other children were asleep.

His great ambition, however, was to be taken on at the colliery where his father worked. He soon joined his elder brother James there as "corf-bitter, or "picker," to clear the coal of stones, bats, and dross. His wages were then advanced to sixpence a day, and afterwards to eightpence, when he was set to drive the gin-horse.

He filled this latter position at Black Callerton colliery, distant two miles across fields

from Dewley Burn, and George was obliged to start from home early in the morning to get to work betimes, and to walk home in the evening under all the disadvantages of a rough and sometimes almost impassable road. Nothing daunted Georgie; he was now a strong growing lad, and as he trudged along with bare feet and legs, he was more concerned about the welfare of the thrushes and blackbirds he might meet than about his own inconvenience in "plodging" through the quagmires and pools that lay in his road. There was not a nest between Dewley and Callerton into which he had not peeped.





CHAPTER III.

GEORGE WISHES TO BE A MAN.

AFTER George had driven the gin at Black Callerton for some time, he was taken on as assistant to his father in firing the engine at Dewley. This was a grand promotion for the boy, whose great ambition was to tend an engine with his father. His only anxiety was lest he should be thought too young for the work. Accordingly, he used to hide himself when the colliery owner paid a visit, in case he should be told he was too little a boy to be earning the wages paid him. When he was about fourteen, however, his position as assistant fireman was fixed at the wage of six shillings a week, and his ambition for the time was satisfied.

But the coal at Dewley Burn was at last worked out, and old Robert and his family

were again obliged to shift their quarters, or to use the common phrase, had to "follow the wark." The next move was to a place called Jolly's Close, near the village of Newburn, where a coal mine belonging to the Duke of Northumberland, called "the Duke's Winnin'," had recently been opened out.

The children of the Stephensons were now growing up, and several of them were able to earn money at various kinds of colliery work. James and George we know helped their father, the two younger boys worked as "pickers" or "wheelers" on the bank-tops, while the two girls helped their mother at home.

Other openings of coal having been made in the neighbourhood, George was removed as fireman on his own account to the "Mid Mill Winnin'," although with no increase of wage. Here he had for his mate a young man named William Coe. A close friendship existed between the two, and they worked in turns for two years at the same engine fire. George wished to earn the full wages of an engineman; with that view he examined his engine minutely, in order to attain such a knowledge of it as would lead to his promotion. When

the Mid Mill was closed, he and Coe were sent to Throckley Bridge, to work a pumping engine; here they remained some months. Here, too, George attained his long-desired wish. One Saturday evening, on coming out of the foreman's office, he announced his good fortune to his fellow-workmen, saying: "I am a made man for life!" His steady, sober, hard-working behaviour had not passed unnoticed, and he was now to receive twelve shillings a week!

A further promotion was soon to be his. His father went to work at a new pit sunk near Newburn Church, to which George was made engineman or "plugman" under the chief engineman. This was a decided rise for the youth, who was even now only seventeen. A "plugman's" duties are to see that the tube of the pump is kept sufficiently plugged when the water at the shaft is at a low level, so as to ensure complete suction, by preventing any exposure of the suction-holes to the air. George now held a superior position to his father; but this fact did not inflate him with pride, nor did he rest satisfied with the knowledge he had already acquired. His engine

became his chief care; he thought of it at night, nor was he ever tired of watching its movements by day. In order the better to study its arrangements, he took the engine to pieces on Saturdays, or when the works were stopped, and examined each part separately. By this means he gained a more practical knowledge of machinery, and kept his charge clean and in good working order. The colliery engineer had seldom to remedy any defects in young Stephenson's machine.

It must not be supposed that George was a quiet, studious young man. He was equal, and in some things superior, to his companions in their athletic exercises. He was not particularly robust, but big and bony, and considered strong for his age. At throwing the hammer George was unequalled. He could also lift heavy weights off the ground by passing a bar of iron through them, then using his knees as a fulcrum, and straightening his spine, raising them sheer up, thus proving how great was the strength of both bone and muscle.

It was now that George began to find out his deficiencies. His active mind wanted to know the reason of many things he saw; he

could see the *how*, but knew not the *why*, so he determined to open the door to knowledge by learning to read. Although eighteen years of age, he did not hesitate, through false pride, to begin at the beginning. So he gave up his recreations and attended a night-school in the neighbourhood for three evenings a week, the remainder of his spare time he spent at home in study. His companions were those of his own class, principally the sons of miners or of other working men whose education had been neglected, either through poverty or indifference. Robert Cowens, the master, was himself a poor man, and perhaps not very efficient ; nevertheless George soon made good progress under him, and they were not a little proud when the toil-worn hands of the young engine-man could slowly trace the letters of his own name.

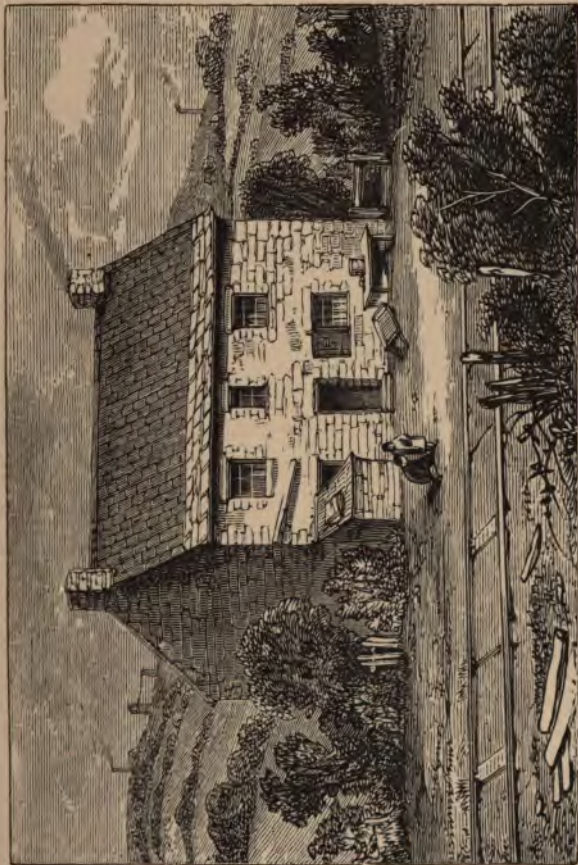
In 1799 he changed his schoolmaster for Andrew Robertson, who had set up a night-school in Newburn. George was averse to giving up his first teacher, but he grudged the time it took to walk to and from Wallbottle, where Cowens lived ; besides which, the Scotch dominie was a good arithmetician, and

this was a branch of knowledge he much wished to acquire. Robert Gray, who was junior fireman at Water-row Pit, where Stephenson, too, was employed, began arithmetic at the same time, but said that George learnt "figuring" much faster than he did; he could not make out how it was, "he took to figures so wonderful." George was no genius, his secret was simply perseverance and a great desire to learn. He worked out his sums at odd times, improving every minute of his spare time by the engine fire, frequently using the sides of the coal trucks as slates, on which he would "set" and solve his problems. Thus he soon became well advanced in arithmetic, and Andrew was very proud of his diligent scholar. When the Water-row Pit was shortly afterwards closed, and George went back to Black Callerton to work, the schoolmaster, who had not an extensive connection, removed there also, and continued his lessons to his favourite pupil.

George did not lose his love of animals in the ardour of his pursuit of knowledge. He gathered the robins and other birds around him, as his father had done, by baiting them

with crumbs. But his chief favourite was his dog, who was so faithful that he could be trusted to carry George's dinner. The tin containing it was tied round his neck, and thus armed nothing could tempt the trusty doggie to loiter on the way, though he had plenty of invitations from all kinds of dogs, who professed great friendship for him when carrying his master's food. He heeded neither friendly overtures nor angry growls, but, like the prophets of old, "turned neither to the right hand nor the left." One day a butcher's great dog espied him, and fell upon the four-footed Mercury. There was a terrible tussle for a time, but our doggie came off triumphant, though wounded in the fray. The *casus belli* was spilt in the conflict, but George was prouder than ever of his dog, although that day he went without his dinner.

It was at Water-row Pit that George learnt to brake an engine. This being one of the higher departments of colliery labour, it was better paid; so George was naturally anxious to learn it. His old friend Coe, who was brakesman here, taught him the art by allowing him to try his hand on his machine, and instructing



THE HOUSE IN WHICH GEORGE STEPHENSON WAS BORN. [Page 30.]

GEORGE STEPHENSON.]

him how to go on. The other workmen, who were jealous of George's rapid advancement, tried to put a stop to this. One of them, a banksman named Locke, used to stop the working of the pit when George was managing the brake. Coe determined to end this opposition ; so one day when he saw the manager of the pit approaching, he called to Stephenson "to come into the brakehouse and take hold of the machine." Locke immediately sat down, and the working of the pit was stopped. The manager asked for an explanation of all this, to which Locke replied that "young Stephenson couldn't brake, and, what was more, was so clumsy he never would learn." He was, however, told to go on, and Stephenson, after a little more practice, was soon perfect in the art of brakeing.





CHAPTER IV.

HE FINDS A TREASURE AND PUTS DOWN A BULLY

"THE work of a brakesman was somewhat monotonous, and consisted in superintending the working of the engine and machinery by which the coals were drawn out of the pit. Brakesmen are invariably chosen from those who have had considerable experience as engine-firemen, and have borne a good character for steadiness, punctuality, watchfulness, and 'mother-wit.' In George Stephenson's day the coals were drawn out of the pit in corves, or large baskets, made of hazel rods. The corves were placed together in a cage, between which and the pit ropes there were usually from fifteen to twenty feet of chain. The approach of the corves towards the pit's

mouth was signalled by a bell, brought into action by a piece of mechanism worked from the shaft of the engine. When the bell sounded, the brakesman checked the speed by taking hold of the hand-gear connected with the steam valves, which were so arranged that by their means he could regulate the speed of the engine, and stop it and set it in motion when required. Connected with the fly-wheel was a powerful wooden brake, acting by pressure against its rim, something like the brake of a railway carriage against its wheels. On catching sight of the chain attached to the ascending corve-cage, the brakesman, by pressing his foot upon a foot-step near him, was enabled, with great precision, to stop the revolutions of the wheel, and arrest the ascent of the corves at the pit-mouth, where they were forthwith landed on the 'settle-board.' On the full corves being replaced by empty ones, it was the duty of the brakesman to reverse the engine, and send the corves down the pit to be filled again."

This was the office that George filled at the Dolly Pit, Black Callerton, in 1801, and his wages varied from £1 15s. to £2 in the fort-

night. It was here that he was enabled to prosecute his various studies with such success. He was put on night duty in his turn, which gave him more leisure than he had during the day. Here he worked out his sums and practised writing by the light of the engine fire, the dark blue vault above him brilliant with countless stars, which shed their soft radiance on the persevering efforts of the future engineer. Here he turned his attention to any books that referred to the construction or application of steam power.

To add still further to his wages, George learnt to mend and to make the miners' shoes. The first guinea he earned in this way was a great stimulus to him, for like most young men he was now thinking of setting up housekeeping on his own account.

He had, for convenience' sake, taken up his abode at a small farmer's near the Dolly Pit, finding his own food and paying so much for lodging and attendance. This mode of living was called "picklin' in his awn poke neuk," and it often happens that the acute young workman contrives to pitch his tent where lives the dear one of his heart.

At any rate, George found a treasure at the farmer's house where Fanny Henderson was servant. Her personal attractions, though considerable, were the least of her charms. Those who knew her well, describe her as possessing a sweet temper, great modesty of demeanour, kindness of disposition, and last, but not least, she also possessed sound good sense.

It has been said that George once mended the shoes of his lady-love, and that he was so pleased with the results of his labour that he carried them himself to her in his pocket, taking them out from time to time on his way, exclaiming, "What a capital job I have made of them!"

Fanny was as much to him as the damsels of old were to their knights, who fought in distant lands to gain favour in the eyes of the lady of their choice. George could not express his love in the same chivalric terms, nor would Fanny have wished him to do so; he showed his love best by keeping aloof from the numerous temptations to which his companions were so addicted; namely, fighting, cock-fighting, drinking, and such like amusements (?).

But George could fight when there was oc-

casion. After he became brakesman at Black Callerton, he had a quarrel with a pitman named Ned Nelson. Nelson was a great roistering bully, and it was well some one should put him down. Stephenson had given him offence in the manner in which he had "braked" the machine; when Nelson was one of the "shift" coming up. He swore at George fiercely because of the alleged clumsiness of his brakeing. George appealed to the others, but Nelson was not an advocate of arbitration, he preferred a downright pitched battle. So George, finding the bully still persisted in his abuse, defied him, accepted his challenge, and a day was fixed for the fight. Great was the excitement when the news got abroad that George Stephenson had accepted Nelson's challenge. Every one said he would be killed; every one wished him good luck, for he was a general favourite, but few dared to utter their wishes. They came to him at the engine house to know if it was true that he was "going to fight Nelson?" "Ay; never fear for me; I'll fight him." For some days previous, Nelson went "off work," for the purpose of keeping himself fresh and strong; while

Stephenson went on with his duties as usual, and appeared not at all put about by the prospective battle. The day came, and in the evening he went into the Dolly Pit Field, where his braggart rival was waiting for him. George stripped, and "went in" like a practised pugilist, though this was his first and last fight. A short time proved that George's wiry strength of muscle made him more than a match for his boastful antagonist, who was severely punished, and we may be sure did not threaten George again, or any one else if George were by. They afterwards shook hands, and continued good friends. In after times his mettle was often tried, though in a different way, and on each occasion he did not fail to exhibit the same resolute courage as he had shown in this encounter with Nelson, the fighting pitman of Black Callerton.





CHAPTER V.

EARLY ORIGINATORS OF STEAM LOCOMOTION.

AFTER working steadily at Callerton for two years, George received an offer to take charge of an engine at Willington Quay, with an increase of wages. He accepted it, and made up his mind to begin housekeeping, Fanny Henderson having promised to marry him as soon as he could offer her a home; and a capital wife she made him. George was young in years, being only twenty-one, but he had always been so steady and so matured in his mind and habits, that few would have taken him for so young a man. He had managed by constant effort and by saving habits to put by enough to furnish a nice little cottage in a comfortable style for his bride elect. It was close to Ballast Hill where George was to

work ; this hill received its name from the heap of ballast that was there thrown out of the ships which called at the quay for their cargo of coal for the London market. The ballast was put into wagons, which were run up to the top of the hill and there emptied. At the foot of this heap of rubbish, George's brake-engine, which was the motive power of the wagons, was placed.

The marriage took place in Newburn Church, on the 28th of November, 1802. George took his bride home to his father's home at Jolly's Close. Old Robert was now becoming very infirm, and only contrived to work as engine-fireman with great difficulty. George did not forget to "honour his father" in deeds as well as words ; he provided for his comfort to the utmost of his power. The journey from Jolly's Close to Ballast Hill was accomplished in very primitive fashion. No post-chaises with postillions and outriders attracted the notice and cheers of the bystanders, no peal of bells rang merrily to welcome them to their new home by the quay. No ; two farm horses were borrowed, and furnished with a saddle and pillion, George

mounting one, his wife seating herself behind him; while the bridesmaid and groomsman followed their example. Thus they accomplished their journey of fifteen miles, passing through the old streets of Newcastle, and by Wallsend to Willington Quay.

The time at Willington flowed quietly on for our two friends: George spent his evenings and spare time in the study of mechanics, and of the principles by which his engine worked. No doubt his favourite books were those containing the wonderful triumphs of Boulton and Watt, the great improvers, one might almost say the originators, of the steam-engine. Except in the actual discovery of the principle of steam power, we owe most of the inventions to these justly celebrated men; it was left to Stephenson to still further improve on their inventions by working out the idea of a locomotive. He was by no means the only one who had thought of this scheme. At the beginning of this present century many minds were engaged in solving the problem of steam locomotives. They wished to employ steam for the conveyance of coal over the tram-roads of the country, and those who were engaged

in the coal trade were pecuniarily interested in promoting the study of the subject. Trevithick, a Cornishman, had constructed a high-pressure locomotive which was certainly far superior to any that had before been made; and although it was eventually set on one side on account of many defects, enough had been done to make a way clear for others to walk in and perfect his somewhat impracticable ideas. Trevithick was clever, but impatient; he could not rise above apparent failure.

Like most mechanics of all times, Stephenson tried to find the secret of perpetual motion. He even constructed a model of a machine, which consisted of a wooden wheel, the circumference of which was fitted with glass tubes filled with quicksilver. As the wheel rotated, the quicksilver was shifted to the lower tubes, and thus a sort of self-acting motion was kept up; but this said "motion" did not prove "perpetual," and Stephenson wisely gave up the problem.

George employed himself more profitably in his spare time by helping to cast ballast out of the ships, and thus earning a few extra shillings for his beloved wife, who in October,

1803, presented him with a son, the Robert of whom we shall hear more hereafter. Great was their joy at their priceless treasure; if possible, George worked harder than ever, for he was determined that his son should not have to struggle for mere maintenance, as he himself had done, neither should he be obliged to pick up knowledge in crumbs and under the many difficulties with which he himself had had to contend in his hard-working and laborious life.

While at Willington Quay, George made the acquaintance of William Fairbairn, afterwards the President of the British Association, who was working at the Percy Main Colliery as an engine apprentice. He was very fond of George, whom he describes as a "fine, hearty fellow," besides being a capital workman; he frequently visited him at Willington, when he would take charge of George's engine, to allow him to take a turn at heaving ballast out of the ships' holds. The friendship of these two young men is very pleasant to think of at the time when they were both obscure workmen in a little northern village; and it did not cease when they became famous in after days.

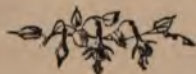
To Fairbairn we are indebted for many of the details of George's home, of the comeliness and good sense of the wife, whose hearty welcome he was always sure of receiving. When at home, he tells us, George was never idle, he continued his shoe-mending, and eventually became so expert that he could make shoes and shoe-lasts as well as any regular shoemaker. An accident occurred in the home which diverted his energies into a fresh and more lucrative channel. The cottage chimney took fire one day during his absence, and the alarmed neighbours in their zeal threw bucket after bucket of water down the ignited flue. This caused the soot to fly in all directions, the nice new furniture was covered with it, the eight-day clock (the pride of every cottage) was thoroughly choked, and disorder reigned supreme. When the place was put "straight" again, George set to work to see if he could mend the unfortunate clock. He took it to pieces, thoroughly cleaned it, and put it together carefully with complete success. After this he was clock-mender in general to all his neighbours, who soon knew the right man to come to in many of their difficulties.

For several years Stephenson tended the engine at Willington Ballast Hill, when in 1805 he moved to Killingworth, to occupy a similar position there. He was reluctant to break up their snug home, and to lose the chance of making extra money by ballast-heaving, but he hoped to make up this loss in some other way. The temptation, too, was great to be employed once more about a mine, for he was to be colliery brakesman at the West Moor Pit, Killingworth, which is about six miles from Newcastle-upon-Tyne, the metropolis of the coal districts in the north.

Hardly a year had passed by, however, when George experienced a severe loss in the death of his devoted wife, Fanny. She died after giving birth to a baby-girl, who only survived her a few months. George keenly felt his bereavement; it seemed as if the light and life of his existence were quenched for ever. He mourned for her sincerely; and when an offer was made to him to take charge of the engine of a spinning mill near Montrose, he thankfully accepted it, in the hopes that change of scene might in some measure assuage his grief. After making all due arrangements for the

welfare of little Robert, he set out *on foot* to his new scene of labour, the distance being more than two hundred miles!

While working at Montrose, he gave many striking proofs of his practical ability and ready ingenuity. The water required for his engine, as well as for the other works, was pumped from a considerable depth, being supplied from the adjacent sand strata. The pumps were frequently choked by the sand which got in through the holes by which the water was admitted into the pump. The barrels became worn, and all the apparatus more or less damaged. A simple but original remedy was soon devised by his fertile brain. He caused a wooden box to be made, twelve feet high, which he placed in the sump or well, and into this he put the lower end of the pump. By this simple contrivance the water was made to flow clear from the outer part of the well over into this box or boot, and thus being free from any admixture of sand, the difficulty was overcome.





CHAPTER VI.

GREAT IMPROVEMENT OF THE PUMPING MACHINE.

STEPHENSON stopped at Montrose a year, gaining the goodwill and favour of his employers and of his fellow-workmen. Having saved £28 out of his earnings, he resolved to go home to his "wee laddie," towards whom his saddened heart yearned. He made the whole journey on foot, as before, to save the expense of travelling by coach or wagon. One night, on his way southwards, footsore and weary, he knocked at the door of a small farmer's cottage, and requested shelter for the night. This was refused ; so he then begged to be allowed to lie down in the outhouse, with a little clean straw for his bed. The farmer's wife opened the door and scanned our traveller very closely. Satisfied apparently with the result of her

scrutiny, she went back to her husband, and, after a little consultation, they invited Stephenson into the cottage. He soon made himself at home there, and amused and interested his hosts with his many anecdotes, and spent some very pleasant hours. He was hospitably entertained, and when, on leaving, he pressed them to take payment, they refused to make any charge, only asking him to "remember them kindly," and if ever he came that way again, to be sure to call on them. This he promised, and many years afterwards, when George was a prosperous man, he did call again, and "remember them kindly," for he left them such a present as reminded them that sometimes angels are entertained unawares.

On reaching home, he found his father in great distress from having met with a severe accident at the pit where he was fireman.

While he was engaged in repairing the inside of an engine, a fellow-workman accidentally let in the steam upon him. The blast struck him full in the face, scorching his face badly, and causing him to lose his eyesight. His other sons were unable to help him, and George was then away in Scotland, and could

not be written to—no one knew how to write! The first thing George did was to pay off his father's debts, amounting to £15, and then to remove both father and mother from Jolly's Close to a comfortable cottage at West Moor, Killingworth, where he could see them frequently, and where he supported them for the remainder of their life.

He was taken on again as brakesman to the West Moor Colliery ; but his prospects just now were not very hopeful. About this time (1807-8) the condition of the working-classes generally was very discouraging. England was engaged in a prolonged war with Napoleon, which pressed heavily on all kinds of industry. Each man, the mainstay of his family, was likely at any time to be called upon to serve either in the army or the navy, and could only be secure by buying a substitute, a costly proceeding for poor men.

Stephenson was drawn for the militia. He had either to quit work, leaving his aged parents and little son without any means of living, or to pay a substitute. He chose the latter, and borrowed six pounds, which, with the remainder of his savings, just sufficed for the purpose.

Thus the whole of his savings were now swept off. He was thinking of emigrating to America, for he was quite in despair, but he could not raise the requisite funds. A good thing for England!

It went sore against the grain to even think of leaving his boyhood's friends, the scenes of the sorrows and joys of his younger days, his little Robert, and the grave of his dear wife, and he brooded mournfully over the idea for some time. Speaking afterwards of this sad time to a friend, he said : " You know the road from my house at the West Moor, to Killingworth. I remember once, when I went along that road, I wept bitterly ; I knew not where my lot in life would be cast."

In 1808 he and two other brakesmen took a small contract to brake the engine at West Moor Pit. The brakesmen were to find the oil and tallow, to divide the work, and to receive so much for their labour. It was then to their interest to economize the working as much as possible. George soon devised the means of making it "pay." He found that the ropes at this pit lasted but one month, whereas in the others they lasted three. He

ascertained the cause, and speedily devised a remedy. With the sanction of the head engine-wright and the colliery owners, he proceeded to shift the pulley-wheels and to rearrange the gearing, which greatly reduced the friction and allowed the work to go on without interruption.

The knowledge he had gained of machinery was soon to be of great use to him. In 1810 a new pit was sunk by the "Grand Allies"—the lessees of the mine—at the village of Killingworth. This pit is now known as the Killingworth High Pit. An atmospheric engine was fixed there to pump water out of the shaft, but it failed to clear the pit. One of the workmen, speaking of this pumping engine, said: "She couldn't keep her jack-head in water; all the engine-men in the neighbourhood were tried, as well as Crowther of the Ouseburn, but they were clean bet." For twelve months had the engine been tried, and it seemed as if it must be given up as useless, for the men were continually being "drowned out." George had taken great interest in the whole matter from the first erection until now. His opinion—he being only a brakesman—was not asked; he

had said, when he saw its first working, that it was defective, and would not be able to "draw" enough water.

His surmise proved correct; but still, in spite of his having previously made improvements in various matters, the owners did not consult the only man who could help them. Often he would inquire or call to see "how she was getting on." From the bank head where he worked he could see the smoke of the engine chimney, and as the men were passing to and from their work, he would call out to know "if they had gotten to the bottom yet?"

On the Saturday after its final break-down he went over to examine it more closely than he had yet been able to do. He turned the subject carefully over in his mind, and satisfied himself as to the cause of failure. Kit Heppel, one of the sinkers, asked him, "Weel, George, what do you mak' o' her? Do you think you could do anything to improve her?" George replied: "I could alter her, man, and make her draw; in a week's time I could send you to the bottom."

Heppel immediately reported this to Dodds, the head viewer, who, being now reduced to

despair and hopeless of the whole concern, thought it worth while to let George try his skill. He could but fail, as the rest had done. So he went off in the evening to find George, and met him on the road dressed in his Sunday suit, going to the "preaching" in the Methodist chapel, which he attended. "Well, George," said Dodds, "they tell me that you think you can put the engine at the High Pit to rights." "Yes, sir," said George, "I think I could." "If that's the case, I'll give you a fair trial, and you must set to work immediately. We are clean drowned out, and cannot get a step farther. The engineers hereabouts are all bet; and if you really succeed in accomplishing what they cannot do, you may depend upon it I will make you a man for life."

Thus stimulated by hopes of reward, and also put on his mettle, Stephenson began operations early next morning. He only stipulated that he should choose his own workmen. He knew there was a good deal of jealousy towards him among the "regulars," in that he, a mere colliery brakesman, should presume to think of remedying defects that the most skilled men of their craft had failed to do; so he wisely chose

men whom he thought would work well under him and obey his orders.

The engine was taken to pieces. The cistern containing the water for injection was raised ten feet. The injection cock, being too small, was enlarged to double its former size, and it was so arranged that it could be shut off quickly at the beginning of the stroke. George altered the pressure from five pounds to ten pounds to the inch, contrary to the rules of Newcomen and Smeaton, both well-known engineers of that time. All these and other necessary alterations were made in three days, and many people came to see the engine's new working, including those who had put her up. The pit was nearly full of water when she first started; there was little to do, and the engine, as George said, "came bounce into the house." Dodds exclaimed: "Why, she was better as she was! Now she will knock the house down." After a short time the bouncing and the bumping moderated, and the working was steady, and by ten o'clock that night the water was lower in the pit than ever it had been before. The pumping was continued all Thursday, by Friday the men were "sent to the

bottom," as Stephenson had promised, and in less than the week the apparatus was in good working order, and the experiment proved to be quite successful.





CHAPTER VII.

GEORGE IS PROMOTED TO BE ENGINE-WRIGHT.

DODDS, the viewer, was much pleased with the speed and efficiency of Stephenson's work, and made him a present of ten pounds, a very inadequate reward in proportion to the service rendered, but quite sufficient, George thought, who received it with great gratitude and delight. He had never earned so large a sum in a lump before, and he was much pleased with this recognition of his skill. Dodds did more than this, however : he appointed him engineer to the High Pit at good wages, while the pit was sinking, and kept him in his mind for further advancement.

Stephenson's skill in engine cures soon became widely known in the neighbourhood, and he found himself engine doctor in general,

as before he had been a watch doctor. All sorts of crazy, wheezing machines were prescribed for by him, and were usually left in far better condition than he found them.

One of his cures is still told by the people of the district. Near Long Benton there was a quarry from which a peculiar and scarce kind of ochre was taken. While it was being worked a large quantity of water collected, and in time effectually prevented any further working of the ochre. The ordinary pumps were used, a windmill was tried, and various expedients resorted to for pumping off the water; but they all failed. George was then consulted. He, in answer to their queries, said, "He would set up for them an engine, little bigger than a kail-pot, that would clear them out in a week." This he did by erecting a little engine which pumped the quarry dry in the course of a few days.

Stephenson was now in the prime of his manhood. He still delighted in feats of agility and strength, and often competed with his fellow-workmen. His success at these times was remarkable. Few, besides himself, could lift such weights or throw the hammer so far,

or cover so large a space at a standing or running leap. One day, between the hours of work, Kit Heppel foolishly challenged him to leap from one high wall to another with a very deep gap between. To Heppel's great dismay, George took the standing leap and cleared eleven feet at a bound! A single slip, and this dangerous leap would have been his last. Another favourite pursuit was horse-riding. In default of a better steed, he would take one of the poor gin-horses, and gallop to his heart's content.

The chief engine-wright at Killingworth High Pit having been killed in an accident, George Stephenson, in 1812, was appointed to take his place with the salary of £100 and a horse to ride upon in his visits of inspection. Now his ambition was gratified! Now he could ride, and on a proper horse too, while travelling from colliery to colliery belonging to the "Grand Allies." The "Grand Allies" were Sir Thomas Liddell, afterwards Lord Ravensworth, the Earl of Strathmore, and Mr. Stuart Wortley, afterward Lord Wharnccliffe. They had heard a great deal concerning Stephenson, and readily agreed to make him their head

engine-wright, showing throughout his future career many marks of their approbation and liking for the clever and withal modest engineer.

Increased responsibility and better pay did not diminish George's labours in the art of self-improvement. Appetite grew with what it fed upon, and he neglected no opportunity of mental culture. His mind and observation became keener and stronger in consequence. Although many of his experiments proved utterly futile, from his not sufficiently understanding the science of mechanics, and although he often *groped* his way through failure to the knowledge that what he had been attempting was quite impossible, yet this very experience, this dark *groping*, was an education in itself. It strengthened his skill and sharpened his faculties, cultivating still further his inventive and mechanical genius.

He had made another firm friend—a certain John Wigham, whose father occupied the Glebe Farm at Benton, quite close to Killingworth. John wrote well, and was a good arithmetician. He undertook George's further education, and was of great use to him. Under Andrew

Robertson, George had found the Rule of Three did very much "puzzle" him; but Wigham led him triumphantly through that Slough of Despond on to the higher branches of arithmetic. Many a sum did George work out on his slate, and when too busy to go to Wigham, he would send his work to be corrected, and receive it back again with fresh sums "set."

John Wigham was useful to him in yet other ways. He was a good talker, great at argument, fairly well read, and a very suggestive thinker. Stephenson looked up to him as to a very clever man indeed. He also taught George to draw plans and sections. But here the pupil soon far outshone the master. This branch of knowledge was extremely useful to Stephenson in after years. A volume of "Ferguson's Lectures on Mechanics" which came in their way proved a veritable mine of wealth to the students. Their friends and neighbours used to wonder what they could possibly mean by their talk about weighing air and water. They were trying the specific gravities of various objects, and many were the mechanical shifts they had recourse to, to gain their point. As may be supposed, Stephenson supplied the

inventive contrivances, while Wigham gave the *rationale* of the experiments. George was extremely grateful for this pleasant and timely help, nor did he cease to remember his friend-teacher when he became *the* engineer of his time.

All this while little Robert was not forgotten. George had hired successively two house-keepers, one of whom married his brother Robert, and the other proved incapable of the charge entrusted to her. His sister Eleanor, three years his junior, then came to act as a mother to the child, and worthily she fulfilled her loving task. An acute sorrow had given a staidness of manner and demeanour that made up for her lack of years, and love gave her tact and patience.

"Aunt Nelly's" kind and gentle disposition soon attracted the child towards her, and he loved her tenderly, though sometimes his mischievous nature caused him to make fun of and to tease his devoted aunt.

Robert was taught that to "help father" was the crowning point of happiness, and nothing delighted the little lad more than to be allowed to do so. He would mount on his little chair

to put on the top of a clock, or any other work his small fingers could manage. When the engine at Ochre Quarry was put up, Robert would look at it for hours with intense eagerness. He watched it when it began to work, and was much annoyed when the fire at first burnt away the grates. The man who fired the engine, being a sort of wag, said to the child: "Those bars are getting verra bad, Robert. I think we maun cut up some of that hard wood, and put it in instead." "What would be the use of that, ye gowk?" said the boy quickly; "you would no sooner have put them in than they would be burnt out again!"

As soon as he was old enough, Robert was sent to the school at Long Benton, kept by Rutter, the parish clerk. But the education given here was of the most limited kind, scarcely more than the primer and "pothooks and hangers." George Stephenson's earnings at this time were comparatively small; for he had to maintain his parents, and the cost of living was extremely high, owing to the war. To cover the extra expense of Robert's education (for which he was determined neither money nor pains should be spared), he fell back on his

old work of shoe-mending and making, and cleaning and repairing watches and clocks, both at home and while tending the engine during the night shifts. (This was before his promotion.) Tailoring, too, he also undertook, cutting out the pitmen's clothes with great success. "Geordie Steevie's cut" was held in great repute, and even in these later days it may be seen round and about Killingworth.

Robert was soon transferred to a better school. In 1815, when about twelve years old, his father sent him to Dr. Bruce's school, in Percy Street, Newcastle; and that the boy might not be overwalked, he bought him a little donkey, on which he rode daily into the town.

There are some who remember seeing the little fellow, dressed in a homely suit of grey stuff cut out by his father, cantering along on his "cuddy," with his bag of provisions by his side, and his satchel of books slung over his back, as happy a schoolboy as any in the land.





CHAPTER VIII.

ROBERT STEPHENSON'S EDUCATION AND TRAINING.

ROBERT was a shy country lad when he went to Mr. Bruce's school, and at first he was much laughed at on account of his strong Northumbrian dialect and his rough, unpolished manners. As he got used to the boys and gradually lost his shyness and his country ways, his love of fun and mischief soon gained him popularity, and he was found to be fully equal to holding his ground with any boy in the school.

He was diligent and steady as a pupil, and as such was held up as an example to the lazy ones; but his progress was by no means extraordinary. He was proud of his achievements in mensuration and mathematics, but strange to say was beaten by a schoolfellow in arithmetic. He certainly gave no striking proof then of the

genius which was to make him famous in after days.

His father took great interest in his progress, and not only kept the boy steadily to his school work, but encouraged him to go to the reading rooms of the Literary and Philosophical Institute at Newcastle, and there study thoroughly any books bearing on the mechanical arts. He used to come home in the evening and give from memory a full description of any plan or drawing that his father required. This strengthened his memory, and gave him the power of accuracy in statement. Added to this, George observing that "a good plan should always explain itself," would place a drawing of a machine or engine before the boy, and say, "There, now, explain that to me—the arrangement and the action." Thus he was taught to read off and describe a drawing as easily as if it were the page of a book.

Notwithstanding this seemingly severe work, Robert was as bright and active a boy as could be seen anywhere. His flow of animal spirits was so great, that had not his father exercised a kind and watchful care over him, he would never have made the man of energy, of quick

and correct judgment, that linked his name with that of his father as one of the great benefactors of his country.

Dr. Bruce relates that when Robert on one of his visits to Newcastle asked an old Killingworth labourer if he remembered him, the man replied, "Ay, indeed! Haven't I paid your head many a time when you came with your father's bait, for you were always a sad hempy?" Smiles, in his "*Lives of the Engineers*," relates how that "in the year 1854 he accompanied Robert Stephenson on a visit to his old home and haunts at Killingworth. He had so often travelled the road upon his donkey to and from school, that every foot of it was familiar to him; and each turn in it served to recall to mind some incident of his boyish days. His eyes glistened when he came in sight of Killingworth pit-head. Pointing to a humble red-tiled house by the road-side at Benton, he said, 'You see that house; that was Rutter's, where I learnt my A B C, and made a beginning of my school learning. And there,' pointing to a colliery chimney on the left, 'there is Long Benton, where my father put up his first pumping-engine; and a great success it was. And

this humble clay-floored cottage you see here, is where my grandfather lived till the close of his life. Many a time have I ridden straight into the house, mounted on my cuddy, and called upon grandfather to admire his points. I remember the old man feeling the animal all over—he was then quite blind,—after which he would dilate upon the shape of his ears, fetlocks, and quarters, and usually end by pronouncing him to be a “real blood.” I was a great favourite with the old man, who continued very fond of animals, and cheerful to the last; and I believe nothing gave him greater pleasure than a visit from me and my cuddy.”

Proceeding farther, Robert pointed to a corner of the road leading from Benton to High Killingworth, where he and others had played a capital trick upon a rough, brutal collier.

“Straker,” he said, “was a great bully, a coarse, swearing fellow, and a perfect tyrant amongst the women and children. He would go tearing into Nanny the huxter’s shop in the village, and demand in a savage voice, ‘What’s ye’r best ham the pund?’ ‘What’s floor the hunder?’ ‘What d’ye ax for prime bacon?’ And after all these questions he would give a

miserable order, garnished with a tremendous oath, of 'Gie's a penny row [roll] an' a baubee herrin'!' " According to the nature of all bullies, he was both a boaster and a coward. Robert and his playmates determined to give him a good fright. "We boys," he said, "believed him to be a great coward, and determined to play him a trick. Two other boys joined me in waylaying Straker at that corner. We sprang out and called upon him in as gruff voices as we could assume, to 'stand and deliver!' He dropped down upon his knees in the dirt, declaring he was a poor man with a sma' family, and asking for 'mercy,' and imploring us as 'gentlemen, for God's sake to let him a-be!' We couldn't stand this any longer, and set up a shout of laughter. Recognising our boys' voices, he sprang to his feet and rattled out a volley of oaths; on which we cut through the hedge, and heard him shortly after swearing his way along the road to the yel [ale] house."

On another occasion he played some tricks that had not so good a purpose. He, like his father, was very fond of reading scientific books and acting on the knowledge thus attained.

Like most boys, too, he was attracted by Franklin's description of the electric kite. Robert expended his small store of pocket money in the purchase of half a mile of copper wire, made his kite according to directions, and insulating the wire by a few feet of silk cord, he proceeded to fly his scientific toy in the fields belonging to Farmer Wigham, where, by bringing the wire over their backs, he soon had the cows "skipping about the field in all directions with their tails up." Another time he saw his father's horse tied to the garden paling, waiting for the master to mount him. The temptation was too strong; bringing the wire over the poor animal's crupper, it received so smart an electric shock, that it was nearly knocked down. At this moment his father came out, riding-whip in hand, and saw the dangerous trick played off upon his faithful horse. "Ah! you mischievous scoondrel!" cried he to the boy, who immediately ran off, fearing the whip no doubt. But the father chuckled inwardly with pride at the boy's daring and success, and Robert escaped that time.

The cottage at Killingworth had been made far more commodious and comfortable than

when Stephenson first became its tenant. He built an oven himself, and added rooms, and in many ways rendered the cottage far superior to those usually occupied by the working classes. His living-room is described as being a perfect museum of curiosities and experimental lumber, watches and clocks, boots and shoes, wheels and cogs, tools of all description, models of self-acting planes, engines and machines lived together in perfect harmony. His odd contrivances often excited the wonder and curiosity of his neighbours. One of the inventions (an alarum) considerably astonished the pitmen when set to the clock of the watchman whose duty it was to call them early in the morning, whilst the women admired his plan of connecting the baby's cradle to the smoke-jack, making them both self-acting. Yet another of his minor inventions was a lamp that burned under water; with this he used afterwards to amuse the Brandling family at Gosforth, by going into the fish-pond at night, lamp in hand, and attracting and catching the fish, which rushed wildly towards the flame.

His love of birds and animals was as strong as ever. Here at Killingworth he had a tame

blackbird, so fond of him that it would fly about the room, and would perch on his finger. A cage was built for "Blackie" and placed in the partition between the room and the passage beyond, a square of glass forming its outer wall. He could see all the movements of his beloved master; and Robert used to describe the oddity of the bird, and to imitate the curious way in which it would cock its head on seeing George enter the house, and follow him with its eye when he went into the inner room.

We must not neglect to mention Robert's sun-dial that still occupies a conspicuous place over their cottage door at Killingworth. It was made at his father's suggestion, who was ignorant of the minute calculations requisite for such a work.

"I expostulated with him at first," said Robert, "that I had not learnt sufficient astronomy and mathematics to enable me to make the necessary calculations. But he would have no denial. 'The thing is to be done,' said he, 'so just set about it at once.' Well, we got a 'Ferguson's Astronomy,' and studied the subject together. Many a sore head I had while making the necessary calculations to

adapt the dial to the latitude of Killingworth. But at length it was fairly drawn out on paper, and then my father got a stone, and we hewed, and carved, and polished it, until we made a very respectable dial of it ; and there it is, you see, still quietly numbering the hours when the sun is shining. I assure you not a little was thought of that piece of work by the pitmen when it was put up and began to tell its tale of time." The date carved on the dial is "August 11th, MDCCCXVI." Both father and son were very proud of their joint production, and when many years later George took a party of savans—who were attending the meeting of the British Association at Newcastle—over to Killingworth, to see the pits, he failed not to call their attention to the sun-dial. Robert, too, on his last visit to the place, pointed out to a friend the very desk he used to sit at while making out the latitude of Killingworth.





CHAPTER IX.

CHILDHOOD OF THE LOCOMOTIVE.

GEORGE STEPHENSON, in his capacity of engine-wright, was necessarily released from manual labour, and was more master of his own time. He had never lost sight of the idea of a locomotive, and had of course seen or heard of the various engines previously invented. He had not fully worked out his plans, and was content to "bide," as they say, till he was certain that success would crown his public experiments.

When the High Pit was sunk, and the coal was ready to be worked, it was Stephenson's winding engine that drew the coals out of the pit, and he it was who projected and laid down a self-acting decline along the declivity which fell towards the coal-lading place near Willington, where formerly he had been brakes-

man; this he arranged so that the full wagons in their descent drew the empty wagons up the railroad.

Sir Thomas Liddell was often about the works, and gave great encouragement to the shrewd and practical engine-wright, whose previous years of patient study were fitting to be a master mind. Sir Thomas saw that he was a man of uncommon genius, who seemed intuitively to comprehend the most abstruse and difficult combinations of mechanics.

Schemes of all kinds were tried for the better conveyance of coal, the traffic of which had so greatly increased. One of these proposed schemes (the latter part of the seventeenth century) was that of hoisting sails upon wagons, and driving them along the wagon-way, as a ship is driven by wind. As may be supposed, this plan did not answer, although it was employed for some time by Sir Humphrey Mackworth, an ingenious coal owner at Neath, in Glamorganshire. This invention was revived in the beginning of the nineteenth century, but was eventually given up, having proved that so uncertain a power as wind could not be relied on for ordinary land traffic.

The first locomotive steam-carriage was built in Paris, as early as 1763, by a native of Lorraine, called Cugnot. It was tried in the presence of the then Minister of War, and several military officers, for it was to be used to drag cannon into the field, instead of horses. At one of the experiments it knocked down a high wall that chanced to be in its way, and yet could not travel faster than two and a half miles an hour, and could only work fifteen minutes at a time—the boiler being too small. Cugnot made several important alterations in it, and the working was more satisfactory. "It was composed in two parts," says Smiles, "the fore part consisting of a small steam-engine, formed of a round copper boiler, with a furnace inside, provided with two small chimneys and two single-acting brass steam cylinders, whose pistons acted alternately upon the single driving wheel. The hinder part consisted merely of a rude carriage on two wheels to carry the load, furnished with a seat in front for the conductor. This engine was tried in the streets of Paris; but when passing near where the Madeleine now stands, it over-balanced itself on turning a corner, and fell over with a crash;

after which its employment being thought dangerous, it was locked up in the Arsenal, to prevent further mischief. The machine is, however, still to be seen in the collection of the Conservatoire des Arts et Métiers, at Paris. It has very much the look of a long brewer's cart, with the addition of a circular boiler hung on at one end. Rough though it looks, it was a highly creditable piece of work, considering the period at which it was executed; and as the first actual machine constructed for the purpose of travelling on ordinary roads by the power of steam, it is certainly a most curious and interesting mechanical relic, well worthy of preservation."

Many other inventions followed this, some of which have before been mentioned, Trevithick's especially exciting much attention. One of his engines was publicly exhibited in an enclosed piece of ground where the London and North Western terminus, at Euston Square, now stands. This was also for the road, and dragged behind it a wheel-carriage full of passengers, while crowds flocked to see the monster. It was suddenly removed by one of Trevithick's odd freaks, and after some

time he brought out his high-pressure steam engine to move on rails. It drew at the rate of five miles an hour, but this was so heavy that the tram-plates and hooks were frequently broken, and on one occasion it ran off the rails and had to be ignominiously dragged back by horses. After this Trevithick gave up the idea of a locomotive, although had he but known it, he was on the eve of the final discovery of the value of the steam-blast, that which made Stephenson the real inventor of our present locomotive engines.

While these and various other experiments were being made in different parts of the country, Stephenson was eagerly studying the same subject at Killingworth.

He saw that all the engines hitherto constructed were clumsy and often inefficient, and very expensive in their working. Profiting by what others had done, and learning from their failures, Stephenson applied himself with ardour to his cherished scheme. He was the man who should accomplish for the locomotive what James Watt had done for the condensing steam engine. He brought his plan of constructing a "travelling engine" under the

notice of the lessees of the Killingworth Colliery in 1813. (The name locomotive was not invented then.) Lord Ravensworth, formerly Sir Thomas Liddell, who as we have seen had taken much notice of Stephenson, authorised him to work out his plans, and advanced him money for the purpose. "The first locomotive that I made," said Stephenson in his speech, many years later, at the opening of the Newcastle and Darlington railway, "was at Killingworth Colliery, and with Lord Ravensworth's money. Yes; Lord Ravensworth and partners were the first to entrust me, thirty-two years since, with money to make a locomotive engine. I said to my friends, there was no limit to the speed of such an engine if the works could be made to stand."

Many difficulties beset the path which led towards Stephenson's goal. One of the greatest was the want of skilled workmen and proper tools. The workmen had to be trained by himself, and to make the best of the clumsy tools then in use. He had his engine built in the West Moor workshops; his chief mechanic was an intelligent colliery blacksmith, an excellent workman in his own business,

but quite unused to the work that Stephenson required.

The first locomotive was made somewhat on the plan of Blenkinsop's (a former inventor); the wheels, however, were smooth, not grooved like those of the previous engines; Stephenson was quite satisfied that the adhesion between a heavily loaded wagon and the rails would be sufficient for the purpose of traction. Robert Stephenson once related how his father caused a number of workmen to mount upon the wheels of a moderately loaded wagon, and to throw their entire weight upon the spokes on one side. It was found that the wagon thus propelled moved easily without slipping. This and other experiments quite satisfied him that smooth wheels were the best, and accordingly his engine was constructed in that manner.

This firstborn of Stephenson's locomotives was called "Blutcher,"—probably the popular way of pronouncing Blucher,—and a most cumbrous, unwieldy monster it was. Besides its ugliness, it kept up such an incessant noise from the escaping steam that it was liable to be indicted as a public nuisance. The terror of both cattle and horses was extreme. Some

means were however found to remedy this fault, increasing at the same time the combustion and effective force, thus saving it from entire banishment. In fact, this escape of steam led to an important discovery, whereby steam was generated in greater quantity, and a constant blast kept up, without adding either to weight or machinery. Stephenson simply led the education steam into the chimney after it had passed through the cylinders, and allowed it to escape in a vertical position.

He made a second engine in 1815, using all his former improvements, and acting upon the suggestions of others. He succeeded in his plan of simple and direct communication between the cylinders and the wheels upon the rails; joint adhesion of all the wheels by the use of horizontal connecting-rods (just as we see them now); and lastly, a beautiful method of exciting combustion by employing the waste steam that was formerly not only useless but a most decided nuisance. These are the main points of all locomotives, and it may safely be said that in this successor to "Blutcher" lay the germs of all the locomotives since constructed.



CHAPTER X.

THE "GEORDY" AND THE "DAVY" LAMP.

IN the course of his experience in collieries, Stephenson had often seen the disastrous effects caused by explosions in the mines from fire-damp. One of these explosions, in which ten people were killed, took place in 1806 at West Moor, when he was brakesman there. This sad accident made a great impression on his mind, and afterwards led to the invention of his safety lamp. More deplorable accidents happened later, one of the worst being at Gateshead, by which no less than ninety men and boys were suffocated or burnt to death.

As engine-wright his duties often led him underground, and at Killingworth, where there were nearly one hundred and sixty miles of gallery excavation, he was necessarily brought face to face with all the dangers of mining.



"ALONE HE WENT TO FACE DANGER." [Page 80.]

GEORGE STEPHENSON.

Many precautions were taken to get rid of the foul air ; but often in vain, and as the men carried lamps or candles entirely unprotected, frequent explosions were the result.

In the year 1814 Stephenson was startled by a workman hastily entering his cottage, saying "that the colliery was on fire !" He immediately hastened to the pit, encountering groups of the panic-stricken wives and children of the unfortunate pitmen. He at once ordered the engineman to lower him down the shaft, and alone he went to face danger, and probably death. Arrived at the bottom, he found the men paralysed with fear, and making no effort for their own or others' safety. Stephenson on leaping out of the corve cried out : " Are there six men among you who have courage to follow me ? If so, come, and we will put the fire out." The men had most perfect confidence in their voluntary leader, and willingly followed him. Swiftly, and in silence, the men set to work. Tools, bricks and mortar, are kept in every mine, and were speedily brought together by Stephenson's direction ; the men began to build a wall between the quarter where the fire was raging and those galleries still untouched,

he himself taking the most active part. The foul air was thus excluded, the fire died out, the lives of the pitmen saved and the mine preserved, through the bravery and presence of mind of one man.

Many a poor fellow had died before he came thus to the rescue, for all could not get to the shaft in time, and when Stephenson was down looking for the bodies, he was asked: "Can nothing be done to prevent such awful occurrences?" He replied that he thought something might be done. "Then," said the other, "the sooner you start the better; for the price of coal-mining now is *pitmen's lives*." Every one seemed to turn to Stephenson to devise remedies, nor did they often turn to him in vain.

What was wanted was a lamp that would give sufficient light to work by, and yet would not take fire when used where foul gas was escaping from "blowers." The means of lighting were either inefficient or dangerous. Something for this purpose had been invented by Dr. Clanny, of Sunderland, but the contrivance was too large and unwieldy, and did not come into general use. In this emergency, a com-

mittee of gentlemen invited Sir Humphry Davy, the most public scientific man of his time, to give his attention to the matter. He accordingly visited the mines in 1815; and in November of the same year he read before the Royal Society of London his celebrated paper "On the Fire-damp of Coal Mines, and on Methods of Lighting the Mine so as to prevent Explosion."

But Stephenson was before him in this, although he was not publicly known. Ever since the last-mentioned explosion, George had been busy trying to solve the problem of light and safety. He made experiments, at the risk of his life, by holding up candles to the windward of the "blower," and studying the various combinations of gas, inflammable and non-inflammable.

In 1815 he was greatly occupied with the locomotive question, and had much to think of. Nevertheless he devoted a portion of his time to a continuation of his experiments on inflammable gas. According to his theory, says Smiles, "he imagined that if he could construct a lamp with a chimney so arranged as to cause a strong current, it would not fire at the top of

the chimney, as the burnt air would ascend with such velocity as to prevent the inflammable air of the pit from descending towards the flame ; and such a lamp, he thought, might be taken into a dangerous atmosphere without risk of exploding."

In August, 1815, he showed his drawings to Nicholas Wood, the head viewer, and afterwards had a lamp made by a Newcastle tinman, while the glass was made at the Northumberland Glass House. Both were received in October, and the trial was speedily made in Killingworth Colliery, October 21st, 1815. "I remember that evening as distinctly as if it had been yesterday," said Robert Stephenson to Mr. Smiles. "Moodie came to our cottage about dusk, and asked 'if father had got back yet with the lamp?' 'No.' 'Then I'll wait till he comes,' said Moodie; 'he can't be long now.' In about half an hour, in came my father, his face all radiant. He had the lamp with him! It was at once uncovered and shown to Moodie. Then it was filled with oil, trimmed, and lighted. All was ready; only the head viewer hadn't arrived. 'Run over to Benton for Nichol, Robert,' said my father to

me, 'and ask him to come directly; say we're going down the pit to try the lamp.' By this time it was quite dark; and off I ran to bring Nicholas Wood. His house was at Benton, about a mile off. There was a short cut through the churchyard; but just as I was about to pass the wicket, I saw what I thought was a white figure moving about among the gravestones. I took it for a ghost! My heart fluttered and I was in a great fright. But to Wood's house I must get, so I made a circuit of the churchyard; and when I got round to the other side, I looked, and lo! the figure was still there. But what do you think it was? Only the gravedigger, plying his work at that late hour by the light of his lanthorn set upon one of the gravestones! I found Wood at home, and in a few minutes he was mounted and off to my father's. When I got back I was told they had just left—it was then about eleven—and gone down the shaft to try the lamp in one of the most dangerous parts of the mine."

Accompanied by Wood and Moodie, Stephenson went towards one of the foulest galleries of the pit, where the gas was issuing through

the fissures with a loud hissing noise. So confident was Stephenson, that he boldly advanced, lamp in hand, to meet the now-to-be-conquered foe. The others prudently retired. Stephenson disappeared from their sight; when he reappeared, he told them that on putting the lamp in the full current of the blower, the flame had first increased, then flickered, and finally had gone out. He returned to his companions, who gaining more courage went back with him, and at a safe distance watched him repeat his experiment. It was just as he had stated. When held full within the explosive gas, the flame greatly increased, and then went out. This operation was several times repeated, Wood himself, finally, holding the lighted lamp to the blower.

Some alterations were made in the lamp, which would cause it to burn better, and Stephenson also discovered that foul air could not pass a tube of a certain small diameter. The trial was again made in the pit in the presence of many people, in a place made purposely foul, and again proved successful. The lamp, however, was not as perfect as the inventor wished. It ought, he said, to give a

better light, and to be kept very steady when burning in inflammable gas. "It struck me," said he, "that if I put more tubes in, I should discharge the poisonous matter that hung round the flame, by admitting the air to its exterior part." He had then no access to scientific books, nor anything to help him beyond his own powers of observation and his practical experience. He made a rough sort of apparatus by which he was able to test the velocity of explosive gas, and the diameter of the tubes through which it would be unable to pass. This was the aim of his experiments. He followed them by others of a similar kind, in order to ascertain whether ordinary flame would pass through tubes of a small diameter. He filed off the barrels of several keys, and placing them together over a strong flame, he satisfied himself that it did not pass upwards; this fact convinced him that he was on the right track.

A second lamp was made, with several small tubes instead of one, by which air was admitted and discharged. "He inferred that a sufficient quantity of air would thus be introduced into the lamp for the purpose of combustion, while

the smallness of the apertures would still prevent the explosive gas passing downwards, at the same time that the 'burnt air' (or azotic gas) would be more effectually dislodged."

This alteration proved satisfactory on the 4th of November; the lamp did not go out as the first had done. Another accident happening, and in the very pit where Stephenson had made his first experiments, he worked still harder to perfect his invention, that no more time might be lost.

A third lamp was ordered on the 20th of November, with additional improvements. This time, instead of tubes, he had holes made in a metal cover to surround the lamp; these holes were at equal distances from each other at the height of the various tubes he had proposed to use, and the top of the glass cylinder was covered by finely perforated metal like a pepper box. The dates of his various trials have to be mentioned, because almost at the same time, Davy brought forward his lamp, made on the same principles, though somewhat differently constructed, and, as we shall see, a great dispute arose between the friends of the two men.

This third lamp was finished and tested in

the Killingworth pits on the 30th of November, 1815; neither Stephenson nor Wood having any knowledge of Sir Humphry Davy or of the experiments he was making. We must remember that newspapers and magazines did not abound in those days, and letters from a distance were very seldom received by busy working men like Stephenson.





CHAPTER XI.

THE SAFETY LAMP CONTROVERSY.

WITH much reluctance, Stephenson consented to bring his lamp before the Philosophical and Literary Society of Newcastle, whose apparatus he had used in making his many experiments. From eighty to a hundred intelligent men composed his audience, but he was unused to public speaking, and had begged his friend Nicholas Wood to be his spokesman. Wood explained the principles of the lamp, but when pressed with questions was unable to reply in full detail ; so Stephenson had to throw off his shyness and to stand up—a noble self-educated and withal modest man—and explain to the satisfaction of the assembly the correct plan of his invention. His strong Northumbrian dialect excited no ridicule, while his earnestness greatly prepossessed his hearers in his favour.

The safety of the lamp was practically proved by his producing several bladders full of carburetted hydrogen, which he had collected from the blowers. With this he surrounded the lamp, and his audience were thoroughly satisfied that he had quite succeeded in his object.

Very soon after this, however, Sir Humphry Davy sent his model lamp to Newcastle to be viewed by the coal-owners there ; on seeing it several exclaimed, "Why, it is the same as Stephenson's !"

They had arrived at the same conclusion by different roads. Stephenson found some of his theories were not quite correct, but his lamp was, and that after all was the main point. He saw and recognised that Davy's lamp was as good as his own—the only claim he and his friends made was that he was the *first* to produce a safety lamp. A long and excited controversy arose respecting their several merits. The Newcastle men stood by their countryman, while Sir Humphry's partisans, to damage Stephenson's claims, sneered at his lowly parentage and position, and inferred that it was impossible he could have produced such an invention, being as they said without chemical

knowledge or the means of arriving at scientific conclusions. Many angry discussions took place and much vituperation ensued thereupon, which was entirely needless. Both lamps were effective, both are used, and Stephenson equally ranks with Davy as the miner's best friend.

To prove the priority of Stephenson's invention, it must be again stated that the "Geordy" lamp was first shown on the 21st of October, 1815. A fortnight later—on the 4th of November—the second lamp was exhibited, equally safe and of greater illuminating power. On the 9th of November Davy's lamp was shown in London, so no one can give Stephenson the discredit (as was attempted) of usurping another man's invention and of claiming it as his own. It is but just to say that Davy did not thus attempt to "run down" his rival; he must not be blamed for the injudicious conduct of his friends.

A meeting was proposed by the coal-owners to testify their gratitude to Sir Humphry for "his invention of *the* safety lamp." It was then that Stephenson's friends pushed forward his claims. Many meetings took place in consequence, and ultimately a sum of £2,000 was

presented to Sir Humphry as the inventor ; while at the same time a purse of 100 guineas was given to Stephenson, "in consideration of what he had done in the same direction."

This result was far from satisfactory, and one of his friends, Mr. Brandling, of Gosforth, suggested that as he was now fairly before the public, he should publish a full statement of the facts on which his claim was founded.

George did not relish the task. He had struggled through his mechanical work, with a very indifferent education, helped principally by his strong good sense ; but writing down his thoughts was a very different matter ! It seemed to him a most formidable affair ; to him it was far easier "to invent a safety lamp or design a locomotive."

He, however, sat down to his unaccustomed task, and called his son Robert to his aid. Between them they composed a long letter, which, after many corrections, was at length fairly copied and taken by both father and son to Mr. Brandling. Looking over the paper, Mr. Brandling said, "George, this will never do." "It is all true, sir," was the reply. "That may be ; but it is badly written." Poor

Robert blushed ; he thought his penmanship was criticised, and he had done his best. Mr. Brandling revised the letter, which was shortly afterwards published in the local journals.

Stephenson's claim to priority was now established in the eyes of all his friends, who called another meeting to consult on the purpose of presenting him with a reward "for the valuable service he had thus rendered to mankind." A subscription was immediately started, headed by the Earl of Strathmore, and money poured in to the amount of £1,000. A silver tankard was purchased with part of the money, which, together with the balance, was presented to him at a public dinner at Newcastle. The tankard bore the following inscription : " This piece of plate, purchased with part of the sum of £1,000, a subscription raised for the remuneration of Mr. GEORGE STEPHENSON for having discovered the fact that inflamed fire-damp will not pass through tubes and apertures of small dimensions, and having been the *first* to apply that principle in the construction of a safety-lamp calculated for the preservation of human life in situations formerly of the greatest danger, was presented to him at

a general meeting of the subscribers ; Charles John Brandling, Esq., in the chair. January 12th, 1818."

Stephenson was much pleased with this public recognition of his services—as who would not have been?—but he was still more pleased by the gift of a silver watch, bought from small collections amongst the miners, and presented as a mark of their personal gratitude and esteem for the man who had lived among them and thought for them for so many years.

Stephenson's own opinion of the two lamps was that their joint adoption would be a great improvement ; that is to say, that the wire-gauze of Davy's lamp, used with his own glass cylinder, would render a safety lamp still more secure. It was not tried, however, and both lamps are used as first invented.

An accident which occurred in the Oaks Pit, at Barnsley, 1857, gave a striking example of the respective qualities of both lamps. The gas suddenly burst out from the floor of the mine for a distance of fifty yards. The men were all supplied with lamps—the hewers with the "Geordy" and the hurriers with the "Davy." The whole of Stephenson's lamps

within an area of five hundred yards went out, while Davy's were filled with fire and became red-hot, so that the men could not hold them. If a strong current of air had been blowing at the time, an explosion must inevitably have taken place from the "Davy" lamp, but the "Geordy" becoming extinguished, no harm could possibly happen through its use.

Nicholas Wood, who was a good judge, has said of the two inventions : " Priority has been claimed for each of them. I believe the inventions to be parallel ; by different roads they both arrived at the same result. Stephenson's is the superior lamp. Davy's is safe ; Stephenson's is safer."





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CHAPTER XII.

THE FIRST LOCOMOTIVE IS USED AT HETTON.

ALL this time the locomotive was not forgotten. The lamp did not absorb all the attention either of George or of the interested public. Although his "travelling engine" of 1815 was still doing good service at Killingworth, it was only regarded by many as a curious toy, and some prophets of evil predicted that some day there "would be a terrible blow-up."

There was, however, so great a saving in the expense of haulage, that most of the colliery masters were induced to adopt locomotive power as a substitute for horse power. One great drawback to its usefulness was the result of the bad and careless manner in which the rails had frequently been laid. Stephenson very early saw how great a power was wasted,

and what a loss ensued from the wear and tear of machinery resulting from this bad state of the roads and from the inequalities of level that were allowed to remain. He was accustomed to speak of the connection between rail and wheel as "man and wife," so closely were their interests united.

His next care was to remedy this defective manner of plate-laying, which he did so effectually that in September, 1816, a patent was taken out for his improved rails in the joint names of Losh, a Newcastle ironfounder, and of Stephenson, the inventor. Mr. Losh, being a wealthy man, and having great confidence in George, found the money for taking out the patent, which at that time was a troublesome and costly affair.

At the same time he made some important alterations in his locomotive, which were also named in the patent. One, the most ingenious and original of his steam inventions, consisted of a substitute for springs in his engine. He contrived that his boiler should rest upon four cylinders, which opened into the interior, and were filled by steam. These cylinders contained pistons with rods, which passing down-

wards, pressed upon the upper part of the axles. "The cylinders opening into the interior of the boiler, allowed the pressure of steam to be applied to the upper part of the piston, and the pressure being equivalent to one-fourth of the weight of the engine, each axle, whatever might be its position, had at all times nearly the same amount of weight to bear, and consequently the entire weight was pretty equally distributed amongst the four wheels of the locomotive. Thus the four floating pistons were ingeniously made to serve the purpose of springs in equalizing the weight, and in softening the jerks of the machine. . . . This mode of supporting the engine remained in use until the progress of spring-making had so far advanced that steel springs could be manufactured of sufficient strength to bear the weight of locomotive engines." Engines made after this plan are still to be seen at Killingworth, for the conveyance of coal trains; their speed rarely exceeds five or six miles an hour, but they do their work as effectually and as cheaply as any of the more perfect locomotives now in use.

The application of the locomotive to the or-

dinary road traffic was again brought strongly before Stephenson's notice, and in 1818 he made, in conjunction with Nicholas Wood a number of experiments which ended in the following result. There were three principal resisting forces to traction. The first was upon the axles of the wheels, the second between the circumference of the wheel and the rail, and the third the resistance of gravity. The force of friction and gravity he could estimate, but the rolling resistance was subject to many variations, owing to inequalities of rail or road. He was satisfied, however, that the roughness of ordinary roads presented an almost insurmountable obstacle to road traction, and this led to the development of the railway system that he was the means of establishing.

Stephenson was powerless to bring this idea prominently before the public. His want of early education made him nervous of either writing to or addressing the public. The colliery fields of the north were far removed from the notice of savans or literary men (except at the time of the safety-lamp controversy) who might easily have brought him forward. Again the thought of trying his fortune in the United

States occurred to him. He had joined a Mr. Burrel as partner in a small foundry at Newcastle, and to him he had suggested a new field of adventure and invention in North America. Steamboats had then been introduced, and he thought he and his partner, with their united powers of engineer and ironfounder, could introduce steamers on the great inland lakes of America.

Fortunately at this time (1819) the owners of the Hetton Colliery, in Durham, had resolved to have their wagon-way altered to a railroad, worked by a locomotive. The general slowness in adopting this was due in a great measure to the additional expense involved in laying down the rails, and purchasing either locomotive or fixed engines, which the coal-owners were often unable to meet, coal-mining being very costly at that time. The Hetton people were, however, possessed of a large capital, and could stand the strain.

Accordingly, Stephenson was invited to act as engineer of the proposed railroad, which was to extend from the Hetton Colliery, about two miles south of Houghton-le-Spring, in Durham, to the shipping places on the river Wear, near

Sunderland. This was but eight miles, but at that time it seemed a great distance. Neither was it an easy line to construct, as the route lay over Warden Law, a very high hill in the district. The road could neither be levelled nor raised sufficiently to overcome this height. Part of the distance Stephenson arranged should be worked by stationary engines, on a self-acting incline, where the full wagons descending drew up the empty ones, on a similar plan to that first made at Killingworth. The locomotive, or "iron horse," as the people called it, did the rest of the work. This line was opened in 1822; crowds of spectators coming from all parts to witness the wonderful sight.

The projector of the next railway was Edward Pease, a man of great courage and indomitable perseverance; just such a man as was needed to push forward the unwelcome railway scheme between Stockton and Darlington. He met with much opposition from the people of the neighbourhood, who predicted the final ruin of all such ambitious designs. The very men whom it was meant to benefit—the merchants and shipowners of Stockton—being the strongest objectors.

Locomotives were not thought of in connection with this line, the Act giving assent to its construction providing only for the making and maintenance of tramroads for "wagons" and other carriages, with *men and horses* or otherwise, provision being also made for any damage done by the "wagoners" in the course of their traffic.

In the spring of 1821, Mr. Pease received a visit from Stephenson and Wood. Stephenson had heard of the Stockton and Darlington Act, and was desirous of exercising his powers on a larger field by being appointed engineer to the projected line. Plans were discussed and designs shown, and Pease soon saw that he had the right man to deal with.

He liked his visitor well; "there was," as he said, "such an honest, sensible look about him, and he seemed so modest and unpretending. He spoke in the strong Northumbrian dialect, and described himself as 'only the engine-wright at Killingworth; that's what he was.'"

Stephenson of course strongly urged the use of steam instead of horse-power, and at last Pease promised to go over to Killingworth and see how the vaunted locomotive worked there.

He was scarcely prepared for Stephenson's bold scheme of employing locomotives instead of horses. Mr. Pease having made inquiries about Stephenson, and gained most satisfactory answers, laid his application for the appointment of engineer to the works before the directors, giving it his strong support. They resolved to adopt his recommendation of a railroad instead of a tramroad, and Mr. Pease was requested to write to him, desiring a re-survey of the line as soon as possible.

A special messenger was sent on horseback with the letter addressed to "George Stephenson, Esquire, Engineer." No one knew our friend thus politely addressed, and for some time the man was quite at a loss what to do. At last it struck some of the colliers' wives that it must be meant for "Geordie, the engine-wright," and the man went accordingly to Stephenson's cottage, and delivered the letter.

In September, 1821, he began his survey, accompanied by an assistant and a chainman, and his son Robert, who entered the figures in a book. He found that the route could be shortened by three miles, at a considerable saving of expense, while in other parts more favourable

gradients could be secured than were at first proposed. It was not intended to use locomotives, but only fixed engines. George, however, got his way in this, much to the ultimate advantage of the directors and all concerned.





CHAPTER XIII.

FORMATION OF THE STOCKTON AND DARLINGTON RAILWAY.

As has been before stated, George was in partnership with an iron-founder. He had invested the balance of his £1,000 in the business, and was now joined by Edward Pease and his cousin Thomas Richardson, and the well-known firm in Forth Street was now to be known as Robert Stephenson & Co. George's name did not appear, as his son was to superintend this branch of industry, and to be in all respects the master.

Here locomotives were made by mechanics who had learnt their trade, for George had suffered much from the ignorance and unskilfulness of his previous workmen. On the 16th of September, 1824, the first order for two

locomotives was given, and accordingly two were built at the cost of £500 each. The first one was called "Locomotion," and it headed the inaugural procession on the opening of the new line. It now stands in the Darlington station, North Road, in an honoured position, on a pedestal.

"The conveyance of passengers," as Mr. Wood remarked, "did not form a part of the original intention of the promoters. The conveyance of coals at the cheapest possible rate was the desideratum and the principle on which Stephenson was instructed to proceed."

In 1833 this company became the sole carriers of goods and passengers.

When the main line was complete, the directors took means to celebrate the opening in a suitable manner. The announcement of the ceremony was given in the following handbill which is copied as far as possible from that originally printed:—

THE
STOCKTON AND DARLINGTON
RAILWAY COMPANY

Whereby Give Notice,

THAT the FORMAL OPENING of their Railway will take place on the 27th instant, as announced in the public Papers.—The Proprietors will assemble at the Permanent Steam-Engine, situated below BRUSSELTON TOWER, about nine miles west of DARLINGTON, at eight o'clock, and after examining their extensive inclined Planes there, will start from the Foot of the BRUSSELTON descending Plane, at nine o'clock, in the following Order:—*

1. THE COMPANY'S LOCOMOTIVE ENGINE.
2. THE ENGINE'S TENDER, with Water and Coals.
3. SIX WAGGONS, laden with Coals, Merchandise, etc.
4. THE COMMITTEE, and other PROPRIETORS in the COACH belonging to the COMPANY.
5. SIX WAGGONS, with Seats reserved for STRANGERS.
6. FOURTEEN WAGGONS, for the conveyance of Workmen and others.
7. *The WHOLE of the above to proceed to STOCKTON.*
7. SIX WAGGONS, laden with coals, to leave the procession at the DARLINGTON BRANCH.
8. SIX WAGGONS, drawn by horses, for workmen and others.
9. Ditto Ditto
10. Ditto Ditto
11. Ditto Ditto

The COMPANY'S WORKMEN to leave the Procession at DARLINGTON, and DINE at that place at ONE o'clock; excepting those to whom Tickets are specially given for YARM, and for whom Conveyances will be provided, on their arrival at STOCKTON.

TICKETS will be given to the Workmen who are to dine at DARLINGTON, specifying the Houses of Entertainment.

The PROPRIETORS and such of the NOBILITY and GENTRY as may honour them with their Company, will DINE precisely at THREE o'clock, at the TOWN HALL, STOCKTON.—Such of the party as may incline to return to DARLINGTON that evening will find Conveyances in waiting for their accommodation, to start from the COMPANY'S WHARF there precisely at SEVEN o'clock.

The Company take this opportunity of enjoining on all their WORKPEOPLE that attention to *Sobriety* and *Decorum* which they have hitherto had the pleasure of observing,

Th: COMMITTEE give this PUBLIC NOTICE, that all Persons who shall ride upon, or by the sides of, the RAILWAY, on Horseback, will incur the Penalties imposed by the Acts of Parliament passed relative to this Railway.

RAILWAY OFFICE, *Sept. 19th, 1825.*

* Any individuals desirous of seeing the Train of Waggon descending the inclined Plane from ETHERLEY, and in Progress to BRUSSELTON, may have an opportunity of so doing, by being on the RAILWAY at ST. HELEN'S, AUCKLAND, not later than Half-past Seven o'clock.

Every satisfaction was felt and expressed at the inauguration of this new line. The programme was carried out to perfection, and the envious had to keep their jealousy to themselves.

An immense concourse of people assembled to see what would happen. Many prophets of evil fully expected to see the "bubble burst," and went to witness the final catastrophe.

The local chronicler of the day almost went out of his senses while trying to describe this "auspicious occasion." "The signal being given," he says, "the engine started off with this immense train of carriages; and such was its velocity, that in some parts the speed was frequently twelve miles an hour!" When it reached Stockton there were about six hundred persons in the train or hanging on to the wagons, which went at a steady pace of from four to six miles an hour from Darlington. "The arrival at Stockton," it is added, "excited a deep interest and deep admiration."

The working of the Stockton and Darlington railway was followed by results far greater than the most sanguine imagination could ever have contemplated. The rates charged were very

low, having been fixed at a $\frac{1}{2}d.$ per ton per mile if for shipment; for land sale, the rate charged was $4d.$ per ton. These rates were fixed through private influence in the Act authorizing their transit; but instead of ruining the directors and all connected with the railway, these measures led to overflowing coffers. The shipment of coal, instead of being a branch traffic, became one of their main sources of profit.

A railway coach, drawn by one horse, was also started on the same rails. Stephenson was authorized to build one, and a very modest and somewhat uncouth specimen of a coach it appeared. A row of seats ran along each side of the interior, while a deal table was fixed in the centre. This coach followed in the grand procession of the 27th of September that we have just described. To modern eyes it would have looked like a travelling caravan containing giants and dwarfs, wild beasts, etc.; but the "Experiment," as Stephenson called it, proved to be the forerunner of a mighty traffic, realizing, like that of coals, sums of money "far beyond the dreams of avarice."

Other coaches soon began to run, the com-

pany letting them to contractors. The "Experiment," being found too heavy, was banished to the coal districts, and competition soon became brisk among the different contractors. The coaches generally used were the old stage-coaches that were now being superseded ; these were mounted upon an under-frame with flange wheels.

As may be expected, this increase of traffic upon a single line caused much confusion. There were four sidings to every mile, however, and here the coaches or wagons had to retire. When two coaches met, or two trains, or a coach and train, the question arose, which should be the one to back ? This was settled quietly ! It came to be understood that full wagons should have preference over empty ones, passengers over coals ; but coaches had to fight it out. At last it was ordered that the coach that first passed a certain post should go on, while the "coming man" should discreetly retire. The first attempt at lighting was introduced in our old friend "Experiment," whose driver, Dixon, used to indulge his passengers with a penny candle placed in the middle of the long deal table.

The Stockton and Darlington directors afterwards took this branch into their own hands, and regulated the traffic, to avoid the confusion that ensued under the contract system.

Middlesborough, at the time of the making of the Stockton and Darlington Railway, consisted merely of a solitary farmhouse and its outbuildings. In 1829 some of the railway proprietors bought land five miles below Stockton for the purpose of forming a new seaport for the better shipment of coals brought to the Tees by rail. This formed the nucleus of the modern Middlesborough. The discovery of ironstone in the neighbourhood has been the means of still more rapidly augmenting the population, and of increasing the business importance of the town. Stockton itself has grown enormously since the making of the railway; while many places, like Middlesborough, owe their existence almost entirely to its introduction.

When Stephenson became prosperous and celebrated, it pleased his generous mind to present Mr. Pease with a gold watch, bearing these words: "Esteem and gratitude: from George Stephenson to Edward Pease."



CHAPTER XIV.

SURVEYS OF THE LIVERPOOL AND MANCHESTER RAILWAY.

THE general means of conveyance between Liverpool and Manchester was by the Bridgewater canal; but the goods traffic had of late years so increased that work was much impeded by the non-arrival of cotton and other cargoes waiting at the canal wharfs to be removed. When there was a frost, too, all traffic by water was at a standstill; altogether, the means of conveyance were quite inadequate to the requirements. As early as 1821 a tramroad was proposed, and many pamphlets were written and meetings held on the subject.

Mr. Sandars, an influential merchant, was in favour of a railroad worked by fixed engines; William James, a man of active temperament, offered his services as surveyor to Mr. Sandars

when he heard of the projected railway traffic between Liverpool and Manchester. The trial survey was made under great difficulties, for the natives of those parts entertained a most cordial hatred to any innovations, any infringement of their "rights." Personal violence was more than once offered, the farmers stationing their men with pitchforks and whips at their gates to drive back the intruders. At St. Helen's a chainman was laid hold of and threatened that he should be hurled down a pit; while a number of men, women, and children ran hooting after the surveyor and his men, throwing stones at them. But that most incomprehensible looking instrument—the theodolite—inspired their keenest dislike, and the men who carried that had a bad time of it.

At last a big, powerful fellow; a noted pugilist, was hired to take charge of the theodolite, in order to protect it; but one day an equally powerful man, a collier belonging to St. Helen's, came to wrench it out of his hand, and a fierce battle ensued. The latter was beaten, but the hostile inhabitants threw volleys of stones at the unfortunate surveyor and his men, and the theodolite was smashed to pieces.

After this Mr. James went to Killingworth and saw Stephenson's locomotive engines at work there. He was much struck at seeing their power and efficiency, and quickly foresaw a glorious future for them. "Here," said he, "is an engine that will, before long, effect a complete revolution in society." To Mr. Losh he wrote expressing his genuine admiration, saying it was "the greatest wonder of the age, and the forerunner, as I firmly believe, of the most important changes in the internal communications in the kingdom." He also informed Stephenson of the proposed railroad between Liverpool and Manchester, and promised that he would strenuously advocate that a locomotive railway should be made instead of one worked by stationary engines.

The survey turned out to be very imperfect; so a second was made, Robert Stephenson this time accompanying Mr. James. He was with him when he tried to lay out the line across Chat Moss—a difficult and somewhat dangerous undertaking, as it is a deep bog. James was a heavy, thick-set man, and one day, while trying to find standing room for his theodolite, he sank down in the bog. With great presence of

mind he rolled himself over and over until he reached *terra firma*, in a sad plight, but quite unhurt. He was obliged to abandon this part of his survey, and as he was not able to complete his estimates in time for the next session, another year was lost. His affairs being in a bad condition, he became ill, and was unable to make any further progress; the committee, therefore, had to seek another surveyor and engineer. Mr. Sandars had visited George, and, like most others, felt that here he had found the right man. The Stockton and Darlington Railway then was approaching completion, and Mr. Sandars found himself charmed with Stephenson's energy and enthusiasm, his readiness in treating difficult matters and his practical way of overcoming them. He strongly recommended Stephenson to the committee, and, as in the case of the Stockton and Darlington board, assent was quickly given.

After many delays, Stephenson began the third survey, meeting with the same opposition from the farmers and others, who were quite convinced that a railway meant everything that was bad—would bring bad harvests, turn men out of employment, increase the rates, and so

on. One of the proprietors declared that he would order his gamekeepers to shoot any persons who should try to survey his property. Following this idea with his usual quickness, Stephenson gave *his* orders too. Some men were sent off to one part of the estate and set to fire guns, thus attracting the keepers' attention, the survey being calmly proceeded with in another quarter.

Now that the canal companies began to realize that their monopoly of traffic was soon to be destroyed, they tried to come to terms and to make improvements in their mode of transit ; but it was too late. A Bill was arranged for debate in 1825. "On this becoming known," says Smiles, "the canal companies prepared to resist the measure tooth and nail. The public were appealed to on the subject ; pamphlets were written, and newspapers were hired to revile the railway. It was declared that its formation would prevent cows from grazing and hens laying. The poisoned air from the locomotives would kill birds as they flew over them, and render the preservation of pheasants and hares no longer possible. Householders adjoining the projected line were

told that their houses would be burnt up by the fire thrown from the engine chimneys, while the air around would be polluted with clouds of smoke. There would no longer be any use for horses, and oats and hay would be rendered unsaleable commodities. Travelling by rail would be highly dangerous, and country inns would be ruined. Boilers would burst and blow passengers to atoms. But there was always this consolation to wind up with—that the weight of the locomotive would completely prevent its moving, and that railways, even if made, could *never* be worked by steam-power.”

Thus appealed to on all sides, the British public did their best to obstruct the Bill, and even those whose interest was chiefly concerned in the formation of railways, told Stephenson that his ideas of travelling at double the rate of a mail-coach were most “absurd.” He had hardly a supporter except Mr. Sandars, who encouraged him and kept his spirits up.

The *Quarterly* of that time observed:—“What can be more palpably absurd and ridiculous than the prospect held out of locomotives travelling *twice as fast* as stage-coaches!

We would as soon expect the people of Woolwich to suffer themselves to be fired off upon one of Congreve's ricochet rockets, as trust themselves to such a machine going at such a rate. We will back old Father Thames against the Woolwich Railway for any sum. We trust that Parliament will, in all railways it may sanction, limit the speed to *eight or nine miles an hour*, which, we entirely agree with Mr. Sylvester, is as great as can be ventured on with safety."

The preliminary Bill went in Committee of the Commons on the 21st March, 1825, when a full discussion arose, legal talent being employed on both sides.

It was April before the engineering part of the question arose, which was the vital element of the whole affair. George Stephenson was called upon to occupy a most unpleasant position—that of witness before a Parliamentary Committee. Speaking of this time, he said: "I was not long in it [the witness-box] before I began to wish for a hole to creep out at! I could not find words to satisfy either the Committee or myself. I was subjected to a cross-examination by eight or ten barristers,

purposely, as far as possible, to bewilder me. Some member of the Committee asked if I was a foreigner, and another hinted that I was mad. But I put up with every rebuff, and went on with my plans, *determined not to be put down.*"

He found it no easy task to make his meaning clear, either to the lawyers or to the Committee. When he had gained more confidence he alluded to his previous experience, pointing out the various small lines that were worked by his engines, many of which he had either laid down or superintended himself. He had made fifty-two steam engines, sixteen of which were locomotives. Some of them were now used on the French lines.

It was on the question of speed that most incredulity was shown. Nicholas Wood, who was present, said: "I believe that it would have lost the company their Bill if he had gone beyond eight or nine miles an hour. If he had stated his intention of going twelve or fifteen miles an hour, not a single person would have believed it practicable."

The Committee entertained great fears that the high rate (nine miles an hour!) was extremely dangerous. "For instance," said one

of the members, "suppose now one of these engines to be going along a railroad at the rate of nine or ten miles an hour, and that a cow were to stray upon the line and get in the way of the engine; would not that, think you, be a very awkward circumstance?" "Yes," rejoined George Stephenson, his eyes twinkling with fun, "Verra bad *for the coo!*" This part of the examination was *not* continued.





CHAPTER XV.

THE LIVERPOOL AND MANCHESTER RAILWAY.

THE next day Stephenson had to submit to a still more searching examination. He was to give evidence on the surveys and plans of the route, designs of bridges and their cost of construction ; here he was less at home than on the subject of rails and engines, and he was sometimes at a loss. To add still further to the difficulties, the surveys were imperfect, Stephenson having discovered that a more favourable line might be made than was mentioned in the plans. This damaged the cause considerably. Part of the route lay over the Chat Moss, which no one would believe could possibly support a railway, floating or fixed.

A leading engineer of the time, Mr. Francis Giles, C.E., who had been twenty-two years

in his profession, gave it as his opinion that "*No engineer in his senses would go through Chat Moss if he wanted to make a railroad from Liverpool to Manchester. . . . A railroad certainly cannot be safely made over Chat Moss without going to the bottom of the Moss.*" Mr. Alderson, one of the chief lawyers, ended his summing up in these words: "I have heard of culverts, which have been put upon the Moss, which after having been surveyed the day before, have the next morning disappeared; and that with a house (a poet's house, who may be supposed to be in the habit of building castles, even in the air), storey after storey, as fast as one is added the lower one sinks! There is nothing, it appears, except long sedgy grass, and a little soil to prevent its sinking into the shades of eternal night. I have now done, sir, with Chat Moss, and there I leave this railroad."

The Bill was not presented to Parliament this session, as it was thrown out in committee, and all things looked their blackest for the railroad scheme. Stephenson was much cast down about it, and many ceased to believe in his powers; but he never for a moment dreamt

of abandoning the cause. A new route was proposed, while the use of locomotives was not insisted on, the promoters declaring that they would "submit to such restrictions in the employment of their line as Parliament might impose."

Public hostility and private interests being thus assuaged, the Bill was successfully passed, both in Lords and Commons, in 1826.

The choice of a working engineer was the next point to be considered. This is generally left in the hands of the principal engineer, but the responsibility was felt to be too grave for ordinary rules to be followed, and the directors very wisely elected Stephenson to the post of resident engineer, at an annual income of £1,000. He immediately removed to Liverpool, and choosing his own subordinates, began the apparently impossible work of making a road over Chat Moss.

Certainly this scheme would not have occurred to an ordinary mind. Michael Drayton once said that the Moss must have had its origin in the Deluge, while the before mentioned Mr. Giles declared that no carriage could stand on it "short of the bottom." The land was

valueless as it stood. Any attempt to utilise it had only resulted in useless expense.

Chat Moss is an enormous peat bog, about twelve miles square. It is unlike usual bogs, which are chiefly made of soft mud; this, on the contrary, consists of a large mass of vegetable pulp, soft and spongy, which has grown year by year higher and higher, as layer after layer of peat springs up from the older growths. This accounts for the phenomenal fact that Chat Moss is higher than the surrounding land; in wet weather it visibly swells, like sponge. All drainage had proved useless, for the drains filled up almost as soon as made.

This then was the giant difficulty which Stephenson proposed to conquer. John Dixon, one of the under-engineers, had the Moss under his charge; neither of the other two (Joseph Locke and William Allcard) envied him his post. When Dixon arrived, Locke proceeded to show him his portion of the line. The drainage had been again begun, but the pulpy sponge had filled up all the ditches. They walked on the planks already laid down; when about half way over, Dixon

slipped and sank to his knees in the bog. He struggled in vain, and would have disappeared altogether had not the workmen come to his assistance. Much disheartened, he wished to give up his post; but Locke showed him how he might avoid similar perils by attaching "pattens," or boards, to the soles of his boots, as had been done in taking the levels and while making the drains.

Dixon felt much perplexed at the idea of making a road to carry heavy locomotives and goods upon a bog that would not even sustain his own weight. The fact is, as may have been guessed, Stephenson intended to make a floating road, on the same principle that a raft or a ship floats on the water.

The first thing was to make a railroad for the wagons which were to bring the materials for working. This was done by making a thick platform of broom or heather, thus forming a kind of foundation; on this the temporary rails were laid. The wagons were propelled by boys, who soon became so expert that they would run the four miles across at the rate of seven or eight miles an hour, without once

slipping; had they fallen, a cold mud bath would have been their reward.

A similar plan was followed for the permanent railroad. Large hurdles, heath, branches of trees, hedge-cuttings, anything that was slightly elastic and would intertwine, was thrown in to form a foundation; over this a thin layer of gravel was spread, on which the sleepers, chairs, and rails were placed. A new form of drainage—invented by Stephenson—took off some of the moisture where the bog was deepest. This was especially the case in the middle, where there was a decided rise, and, in consequence, an incline on either side. Stephenson had long lines of tar barrels put here, end to end like our ordinary drainage pipes. These were firmly fastened together and floated by their own buoyancy.

This part of the work presented no great difficulties. An embankment was necessary at the Manchester end of the Moss, and here the chief difficulty arose. The bog seemed to swallow up all the earth, dry moss, heather, and other materials, without being any the firmer. This work went on for weeks, and like Pharaoh's lean kine, the more the bog

swallowed the less there seemed to show for it. The question even arose whether the work should be abandoned. The expense was enormous; but the directors and others had lost too much already, and guided by Stephenson the work went on. He never lost heart; through all the discouragements his motto was "Persevere!" "With money, materials, and men," said he to one of the directors who was making complaints, "I can make a railroad over Chat Moss. We must keep filling in; there is nothing else for it. The stuff is doing its work out of sight, and it will soon show, *if you will only have patience!*"

Robert Stephenson, whose career will be followed in another book, had left England for South America, where he was a mining engineer. At his father's urgent request he returned to England in 1827, and once more assumed the management of the ironworks at Newcastle-on-Tyne, which had suffered in his absence, and it was under his management the *Rocket* was made, the first locomotive that ran on the Liverpool and Manchester line. We must go forward a little, and say that this line was formally opened on the 15th of September,

1830, a complete triumph of engineering skill and perseverance.

Many greater works than the line across Chat Moss have been made since, with increased appliances and mechanical skill; but such a triumph of perseverance against enormous odds has scarcely, if ever, been equalled in all the annals of engineering! Instead of being the most expensive part of the line, it was by far the cheapest. Being a floating road, the motion over it is smooth and even, as the pressure is equal at all points.

The construction of other portions of the line was also attended with considerable difficulty and expense. Stephenson was compelled, by the opposition of landowners, to make a tunnel under Liverpool one and a half miles in length; then a long and deep cutting through the red sandstone rock at Olive Mount; and lastly, but the most serious of all, the Sankey viaduct, extending from the Whiston to the Sutton hills. This consists of nine arches of fifty feet span each. The piers are supported on two hundred piles driven deep into the soil, which is sandy in some places and soft in others. The coping of the parapet is seventy feet

above the Sankey brook and canal which flow beneath. This enormous pile of masonry was not made without danger, but Stephenson shared it with his men, who had the greatest confidence in him.





CHAPTER XVI.

THE TRIAL OF THE "ROCKET."

THE trial of the locomotives for the Liverpool and Manchester Railway began at Rainhill on October 6th, 1829, and lasted till the 14th, when a prize of £500 was to be given to the maker of the one that was deemed best.

The firms who entered into competition were Messrs. Braithwaite & Ericsson, who exhibited the *Novelty*; Mr. Timothy Hackworth, who exhibited the *Sanspareil*; Messrs. R. Stephenson & Co., who exhibited the *Rocket*; and Mr. Burstall who exhibited the *Perseverance*. Each was to make twenty trips on a level piece of railroad nearly two miles in length, and the average speed was not to be less than ten miles an hour. The prejudice against this excessive speed was

now overcome! As might be expected, the *Rocket* was first ready. It was not by any means a favourite, being both clumsy and awkward in shape. In its first trial trip it ran twelve miles in fifty-three minutes. Rainhill throughout the trial presented the appearance of a grand race day, and so it was a race, but between iron horses! People crowded to the stands, carriages and horses lined the roads and intercepted the view of the less fortunate spectators, flags waved and bands played, and a casual looker-on might have thought it merely a day of pleasure.

The *Novelty*, a light and compact engine, then ran its trip, easily making twenty-four miles, but without any adequate load. The chief difference between it and the *Rocket* lay in the bellows, which forced the air through the fire, thus creating the draught which in Stephenson's locomotives was always caused by steam. These blast-bellows of the *Novelty* the next day were found to have given way, so its further trial was postponed. The *Sans-pareil* had some defect in the boiler, and had to be repaired. The spectators were naturally disappointed when no trial seemed to be forth-

coming ; so Stephenson, always genially disposed, brought out the *Rocket*, and attaching a coach thereto, filled it with passengers, ran up and down the line at the rate of twenty-four to thirty miles an hour, much to their wonder and delight.

The *Rocket's* final trip was taken the next day. Thirteen tons weight was dragged after it in ten continuous trips. Ten more trips were taken to complete the required seventy miles, when it was found that the maximum velocity far exceeded the speed required. The average speed amounted to fifteen miles an hour, five miles beyond that necessary for the trial. When the *Rocket* arrived at the grand stand, having fulfilled all the conditions of the contest, one of the directors, who had till then favoured the fixed engine system, exclaimed : " Now has George Stephenson at last delivered himself ! "

The *Novelty* came forward again, but the bursting of the pipes of the forcing-pump put an end to its hopes. The *Sanspareil* was found to be four hundredweight less than the requisite weight ; while the *Perseverance* was put out of the running altogether from the fact that its

speed only averaged five or six miles an hour. A further trial was given to the *Novelty* and the *Sanspareil*; but they were not more successful than before, so the *Rocket* was left undisputed master of the field. The prize was therefore awarded to Messrs. Stephenson & Co., who were greatly pleased at the result. Stephenson then took off all superfluous weight from the engine, and ran it along for two trips at the then unprecedented rate of thirty-five miles an hour.

No choice was now left but to adopt the locomotive. Grumblers were silenced and doubters convinced. The success was so notorious that the shares of the company immediately rose ten per cent., while stationary engines, with their houses, ropes, and all their cumbrous machinery, were abandoned for ever.

Nothing but praise was given to the "unwearied skill and energy" of the man by those who, in the days of his adversity and struggles had no better name for him than "fool and "fanatic." His real friends pressed round him, and congratulations poured in on every side. We need scarcely say that such a noble man

as George Stephenson neither bore malice nor entertained unkind feelings towards those who had made his work so hard and had so embittered his life. Neither did he fail to recognise and to appreciate those who were faithful; he knew quite well which were his "fair-weather" and which were his "foul-weather" friends.

Stephenson continued to make many improvements in the *Rocket* and the other locomotives which were to run on the now completed line. The first entire trip was made on June 30th, 1830. The train was drawn by the *Arrow*, one of his later works, which he drove himself, while Captain Scoresby, the circum-polar navigator stood by him and timed the speed. Chat Moss was crossed at a speed of twenty-seven miles an hour. The public opening took place in September, 1830; the event was truly deemed national, and was treated accordingly. The Duke of Wellington, then Prime Minister, Sir Robert Peel, and Mr. Huskisson, one of the members for Liverpool, being among the passengers. Thousands of spectators lined the entire route, and cheered the trains as they passed "through the deep

ravine of Olive Mount, up the Sutton incline, over the great Sankey viaduct, beneath which a great multitude of persons had assembled, carriages filling up the narrow lanes and barges crowding the river; the people below gazing with wonder and admiration at the trains which sped along the line, far above their heads, at the rate of some twenty-four miles an hour."

A sad accident threw a gloom over these triumphant proceedings. Mr. Huskisson, who had stepped out of his carriage at Parkside, near Liverpool, was standing by that of the Duke of Wellington. They were waiting for the *Rocket* on the opposite set of rails, which was to pass in review before his Grace. At last the train was observed coming up at full speed. "Get in, get in!" shouted the bystanders. Hurriedly Mr. Huskisson sought his carriage, getting on the other rails to do so, and in the way of the *Rocket*, whose speed could not be checked in time. He received severe injuries, and his first words, "I have met my death," proved but too true, for he died the same evening.

The Duke and Sir Robert wished to return to Liverpool, but were persuaded to continue

their journey for fear of causing a panic. A rumour had indeed preceded them to Manchester, and all discipline was at an end. People at Manchester and other places where they stopped, pushed forward and hung on to the carriages in such a way that it was marvellous no further accident happened. The Duke wisely remained in the train, calmly and pleasantly receiving all those who came to him, especially the women and the children, who were unceremoniously pushed forward by the rough men who would willingly have raised a political tumult.

The line was opened for public traffic next day, when a hundred and forty passengers were booked for the first train. Since that time the traffic has never ceased. No detail of improvement, however small, escaped George Stephenson's notice. The self-acting brake, now discarded on many railways, was one of his inventions. It is curious to know that this same brake has been revived in France by a noted French engineer. Great numbers of people crowded to Lancashire curious to see the wonderful mail-coaches running without horses, headed by a great steam monster

spitting out fire like the fabled dragons of olden days.

Line after line has since been made. Some recklessly and ruinously by dishonest or careless projectors, but with none of these had Stephenson to do. We will now only deal with the Leicester and Swannington Railway, of which his son Robert was engineer. A large coal-field was discovered near Snibston during its formation. Stephenson induced some friends to join him, and purchasing the estate, began to open out the coal-mine, greatly to his own benefit and that of the neighbourhood. Coal became reduced to eight shillings a ton, a great saving to those who hitherto had had all their coal from Derbyshire. Stephenson had the pleasure of sending his first coal-train to Leicester.

The correct principles upon which he worked his mine influenced other coal-owners, who could not fail to be struck with their economy, good sense, and efficiency. He freely showed all his improvements, and the reason of his rules, only too glad to be of use to his fellow-men and to those from whose *ranks* he had sprung. Unlike most self-made

men, he was neither cringing to his social superiors nor arrogant to his inferiors. He was a kind and thoughtful master, never forgetting what was due from himself to his men.

For many years he lived at Alton Grange, a comfortable house near Snibston, where he superintended the mining operations, and from whence he could easily travel whithersoever his multiplied duties called him. With true liberality he provided for the wants of his work-people at Snibston, seeing first to their home accommodation, then building a church and a chapel, with schools attached to both, so that both temporal and spiritual wants were fully provided for. This he did freely and unostentatiously, unconsciously exercising a good influence on all employers of labour, who could not fail to see in him that "noble man" who is "the noblest work of God."

In 1840 he retired from active life, and devoted himself to his garden at his new abode, Tapton House, near Chesterfield, where a new seam of coal had been opened by himself and several others. Here he had leisure to pet birds and animals to his heart's content, and here he was the honoured and beloved host to many a

brilliant circle of the best thinking men of the time. Here, too, he lived till 1848, when he passed away from all the struggles, the fame and the glory of this world.

Through his means, nations hitherto sundered have been united, and commerce and prosperity enormously increased. He lived to see his dearest wish gratified. He worked not for honour and glory—though these came to him—but for the real welfare of his fellow-man. His far-seeing eyes could read the future, and that future has been entirely fulfilled. The keystone to his remarkable success was alluded to in the course of his speech addressed to the Leeds Mechanics' Institute, when he said : " I stand before you as a humble mechanic. I have risen from a lower standing than the meanest person here, and all that I have been enabled to accomplish in the course of my life has been done through PERSEVERANCE ! "



